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ROYAL BOTANIC GARDENS, KEW

IX.—CENTENARY OF THE ROYAL BOTANIC GARDENS, KEW.

The completion of the first hundred years of the existence of the Royal Botanic Gardens, Kew, as a Government Institution occurred on April 1st, 1941, for it was on April 1st, 1841, that Sir William Jackson Hooker, then Regius Professor of Botany in the University of Glasgow, took up his duties as the first Director of Kew after the Royal Gardens had been handed over by the Crown to become the National Botanic Garden.

The history of the Royal Gardens up to the year 1841 has been given by Sir W. T. Thiselton-Dyer in the Kew Bulletin (1891, pp. 279–327), and it is hoped, when conditions allow, to publish an account of the growth of the Gardens and of the various changes which have taken place during the past 100 years.

An article which was published, with some excellent pictures, in "Country Life" on March 29th, 1941, and which is here reproduced, with some alterations, by the courtesy of the Editor, gives a brief account of some of the additions to the Gardens and of the more important activities during the past century. A leading article on the subject was published in "The Times" on April 1st, and there were articles in "Nature" (April 5th, 1941, pp. 400–403), the Journal of the Royal Horticultural Society (lxvi, pt. 5, p. 154), and other publications. An address on the Centenary was given by the Director at a meeting of the Linnean Society on April 3rd.

Owing to the War no official celebration of this historic event could be held, but a letter of congratulation was received from Her Majesty Queen Mary, and letters and telegrams were sent by botanists and botanical institutions in Great Britain, Canada, South Africa, Australia, India, Fiji, and the United States of America. Some of these are here reproduced.

> "Best wishes and congratulations on your April First Centennial."
>
> (Dr. W. J. Robbins, Director, New York Botanical Garden.)

> "Hearty Congratulations Best Wishes for many more Hundred Years of Kew in the service of Botany and Horticulture."
>
> (Dr. George T. Moore, Director, Missouri Botanical Garden, St. Louis.)

" Warmest felicitations from the Fellows of the Royal Society of Canada to the Director and Curators of the Royal Botanical Gardens on occasion of Centenary. May the stimulus to botanical research which has been so great a contribution from Kew in the past be continued in ever increasing measure in the years to come."

(R. C. Wallace, President.)

" Continued success and prosperity to Kew the symbol of a science of peace one of the great forces in the development of the Empire and source of invaluable contributions to the health and welfare of mankind on behalf of all Canadian Botanists."

(H. T. Gussow, Dominion Botanist, Ottawa.)

" Hearty Congratulations on Kew Centenary from Cambridge Botany School and Garden Staff."

(Professor F. T. Brooks, Professor of Botany, Cambridge.)

" Heartiest congratulations. May Kew's second Century be as auspicious as its first."

(Department of Botany, British Museum.)

From Dr. E. D. Merrill, Director, Arnold Arboretum, Harvard University :—

" I take this opportunity of expressing to you, to the staff, and to the administrative bodies concerned with the institution, our appreciation of the outstanding services that Kew has rendered, and is still rendering, to botanical and horticultural sciences from a World standpoint. Botanists and botanical institutions everywhere are under a tremendous debt of gratitude to the institution, to you as Director, and to your very able predecessors from the time of Sir William Hooker, for outstanding services rendered. It is almost a trite saying that Kew is the storehouse of World botany, for it is just as true today as it was when the expression was originally used many years ago.

We all naturally regret the combination of circumstances that has made this, and the past year, peculiarly difficult for the institution, and we regret, more than all else, the extensive damage that has been caused by indiscriminate bombing. Again, we regret that this centenary could not have been celebrated in a manner which such an important event deserves, but it is, of course, understandable why the date should be allowed to pass without international recognition of its importance."

From Dr. C. Stuart Gager, Director, Brooklyn Botanic Garden :—

"Brooklyn Botanic Garden wishes to express to Kew its hearty congratulations and felicitation on the rounding out of the first hundred years of this institution, which I think may be properly designated not only as the leading botanic and horticultural institution of the Empire but also as the most important botanic garden in the world. What a pity it is that the present situation in Europe makes it impossible for you to hold a celebration in keeping with the place of Kew in the botanical world and the value of its accomplishments to botany and horticulture!

May I add my personal congratulations to you as the Director of Kew to these best wishes of the officials and staff of the Brooklyn Botanic Garden."

From Professor R. H. Compton, Director, National Botanic Gardens, Kirstenbosch :—

"First let me offer you most cordial congratulations on the centenary of Kew. Kew is *the* world's botanic garden, *par excellence*, and Kirstenbosch is one of the many institutions which have derived inspiration, help and encouragement from Kew. We feel deep gratitude to Kew, whose very existence and success has made possible the establishment of so many other botanic gardens, Kirstenbosch among them. And we pay a high tribute of admiration to Kew for the outstanding work of its first century in systematics and horticulture and in the enrichment of life in many aspects.

May I add my very sincere personal congratulations to you and your staff for the courageous way in which you are meeting the difficulties of the present time, and express the fervent hope that the war may spare the irreplaceable treasures of Kew."

From Sir William Wright Smith, Regius Keeper, Royal Botanic Garden, Edinburgh :—

"In these troublous times one is often guilty of acts of omission for which there is little or no excuse. How it came about that I did not send a letter of congratulation on the Centenary of Kew I cannot account for. I trust however to be forgiven and to make amends. Kew stands with me always in the highest regard and my good wishes if somewhat belated are of the most sincere. The relations between Kew and Edinburgh—*Consule Hill atque Consule W. Smith*—have been all along of the happiest and there is still the prospect of that slight extension of our service and so *finis* is not written just yet. I would that I had written earlier but be so good as to enrol me still amongst those who tendered their felicitations in token of admiration."

From Dr. J. Walton, Regius Professor of Botany, The University, Glasgow :—

"I notice in 'Nature' an announcement that you are to address the Linnean Society on the Centenary of Kew. Permit me to send respectful greetings to the Royal Botanic Gardens from the Department of Botany in the University of Glasgow on the Centenary of the departure of Sir W. J. Hooker from Glasgow to take up his duties at Kew. As a humble successor to the Chair which he occupied here I can perhaps rightly claim the privilege of sending these greetings."

From Sir William Collins, Chairman, Chelsea Physic Garden Committee :—

"May the Chelsea Physic Garden join in Centenary salutations to Kew, remembering the association through Aiton, the pupil of Miller, of the two Botanic Gardens? I am sure all the members of the Chelsea Garden Committee would wish to join in felicitations to their highly esteemed colleague of Kew who so ably presides over that royal demesne."

From Mr. Eric Macfadyen, Chairman, The Imperial College of Tropical Agriculture :—

"I have only just learned of the Kew Centenary. Although the times we are living in must preclude the public celebrations by which the date would normally have been distinguished, admirers of Kew in all parts of the world will wish to mark their grateful appreciation of the incomparable record of service to botanical science of your great Institution from the days of Hooker to those of Hill; and I know that our colleagues on the Governing Body would wish to be numbered among those who record their acknowledgment of the occasion. In their name may I offer you, on behalf of the Royal Botanic Gardens, our sincere felicitations and best wishes for the next one hundred years?"

From Charles Alexander Hill, Chairman, and Arthur Mortimer, Secretary, The Wholesale Drug Trade Association :—

"The Council and members of the Wholesale Drug Trade Association send their congratulations to you on the occasion of the one hundredth anniversary of the opening of the Royal Botanic Gardens to the public.

This Association realises, perhaps more keenly than other bodies, the value of Kew to the Community and the Empire, and the help that Kew has given to the commercial side, not only with regard to assisting the Empire with plants of all kinds for cultivation, but also the help which it has given to the drug trade at home in getting the best results from the vegetable herbs and drugs that are grown and imported.

We are grateful for all that has been done and send our very best wishes for the future success and prosperity of these historic Gardens."

From the Bishop of Kingston :—

" In the absence of the Diocesan (Bishop of Southwark) on behalf of the Diocese, I write to congratulate you and to say we share in your happiness. It is wonderful what the Gardens have done and are doing. They have made a real contribution to the life of the Empire. Long may they live and grow ! "

From Councillor Miss Mabel Lawrie, J.P., Mayor of Richmond :—

" On behalf of the Burgesses of this Borough I send you hearty congratulations upon the occasion of the Centenary of Kew Gardens, as a Government institution.

During all the past years, with its great contribution to botanical research, Kew Gardens has been a tie binding the Motherland to the Dominions, and as such, is a heritage which must be saved to us.

Kew Gardens is also, to many, a haven of peace, and perhaps, in these troublous times, more appreciated for that reason.

May the work and the blessings of Kew Gardens be continued for future generations."

(Reprinted from " Country Life.")

The Royal Botanic Gardens, Kew, have grown gradually to their present size and importance without having been conceived on any premeditated plan, and as they may be seen to-day, they are very largely the result of Sir William Jackson Hooker's foresight and enterprise.

The original Botanic Garden was started by Princess Augusta about the year 1760, and it was after her death, between the years 1772–1820, that so much was done by Sir Joseph Banks, working with George III, in building up the collections by sending out collectors all over the world, in developing the resources of the British possessions overseas, and training men to take charge of the various Colonial botanic gardens. On the deaths of George III and Sir Joseph Banks in 1820 the Gardens gradually fell into a state of neglect and their abandonment was seriously considered, but, thanks to the appointment of a committee, of which Dr. J. Lindley and Sir Joseph Paxton were the principal members, it was finally decided, in 1840, to take them over as a national institution. Sir William Hooker, then Regius Professor of Botany at the University of Glasgow, was appointed Director, and took up his duties on April 1, 1841.

When Sir William was appointed, the Botanic Garden consisted of only 11 acres. In the following year, thanks to the interest of Queen Victoria, he was able to get 4 acres added near the present Main Gate, and two years afterwards Her Majesty granted him 47 acres out of the pleasure grounds, and in 1846, 14 further acres were added, which had formerly been the Royal Kitchen Garden. Thus, in the course of five years after his appointment the Garden under his charge had extended to 76 acres.

Not long after this he was given control over the pleasure grounds, which extended as far as the Old Deer Park and included the Queen's Cottage grounds (opened to the public in 1897). The whole area included in the Kew demesne now amounts to a little over 318 acres.

With the acquisition of the extra ground, Sir William Hooker at once set to work to develop the Royal Botanic Gardens. The 4 acres added near No. 1 House enabled the new entrance gates on Kew Green to be erected from the designs of Decimus Burton, 1845, and with the other additions Sir William was able to put forward his proposals for the building of the Palm House, for which Decimus Burton was also the architect. The Palm House was erected in 1844–48 on a terrace built up partly on the site of the old pond. Nesfield was then called into consultation with regard to the general lay-out of the grounds. He designed the Broad Walk from the Old Orangery to the pond and its continuation at right angles, leading to the new Main Gates on Kew Green. The design was centred on the Palm House, and Nesfield embanked the pond on its present lines, and laid out the parterre between it and the Palm House, and also the formal semi-circular garden enclosed by a yew (now holly) hedge with conical holly bushes on the western side ; and he opened up the three vistas into the pleasure grounds towards Sion House, the Pagoda, and the old cedar tree to the north-west.

Though the pleasure grounds were separated from the Botanic Gardens by a light iron fence, which ran from the Unicorn Gate in a semicircle round behind the Palm House to Kew Palace grounds, Sir William was also able to prepare schemes for their general development as part of the Gardens, since, fortunately, he had control over both areas.

He had for some time put forward proposals for the erection of a house for New Holland plants, which resulted in the building of the Temperate House. This, like the Palm House, was designed by Decimus Burton, but only the central portion and the two octagons were completed in Sir William's time, in 1862, and it was not until 1899 that the second of the two wings—the northern one—was erected. The Temperate House is built on a terrace made up of the material excavated from the lake which was partly made by Sir William. As soon as he became Director he opened the Gardens to the public and did all he could to make them instructive and attractive to visitors.

Sir William came to Kew with very clear and definite ideas as to what a national botanic garden should include, and one of these was a museum for the display of the economic products derived from the vegetable kingdom. He was fortunate in being able to interest Queen Victoria in the project, and the Royal Fruit Store, the present Museum No. 2, was handed over to him for the purpose. This was quickly filled with his own collections and with many gifts from outside, and in 1847 the Museum was opened—the first Museum of Economic Botany to be founded in this country. So greatly did

the collections in the Museum grow that it became necessary to erect a new building, and No. 1 Museum by the side of the pond was built in 1857. Later, a third museum was added when the old Orangery became available, after the building of the Temperate House, and this was devoted to a display of colonial timbers in 1862. Since then, a further addition to the museum accommodation at Kew has been made in Cambridge Cottage, the present No. 4 Museum, which was handed over to the Gardens by King Edward VII in 1905.

A herbarium and a library, Sir William also pointed out, were essential constituents of a botanic garden, but Kew possessed neither. Sir William, however, generously placed his own extensive collection of herbarium specimens and books at the disposal of all visiting botanists. It was not until the year 1852, when the Director was given an official residence, that the present Herbarium building, which had formerly been the residence of the King of Hanover, was handed over for the Herbarium and Library. This building, it is interesting to recall, had previously been used by Sir Joseph Banks for his herbarium, which he bequeathed to the nation. This on his death was moved from Kew and formed the nucleus of the British Museum botanical collection. The Herbarium and Library have grown very greatly since Sir William's day; a wing was built out at the back of the original house by Sir Joseph Hooker in 1877, a second wing to the south was added during the directorship of Sir William Thiselton-Dyer in 1902–03, and the last extension—a large wing with four floors, parallel to the original one—was erected in 1932.

In addition to a herbarium, library and museums, a botanic garden should have a laboratory for physiological and other botanical investigations. This valuable addition was made in the years 1875–76, thanks to the munificence of Dr. T. J. Phillips Jodrell.

The gardens, therefore, have now all the necessary adjuncts for the conduct of the various branches of botanical work.

A very interesting addition was made to the Gardens in 1882, when Miss Marianne North presented her Gallery. She filled it with a remarkable collection of about 850 oil paintings of plants and flowers, which she had made all over the world between 1872 and 1885.

Mention may be made of a few other additions, which are of some historical interest, one being the Tropical Water-lily House, No. 15, which was built in 1852 for the display of the recently introduced Victoria Regia water lily. A rock garden was made by Sir Joseph Hooker in 1882, by the old ice well, where the hardy ferns are now planted, and he prophesied that this would no doubt soon become one of the most popular branches of modern horticulture. A few years later the need for a more extensive rock garden was put forward, and thanks to the presentation of the collections of Mr. George Joad of Wimbledon, the present Rock Garden, modelled on a dry Pyrenean valley, was built. This has been considerably

extended, especially at the northern end, in recent years. The stone at the southern end is limestone, while the newer part at the northern end has been built up of Sussex sandstone. The Alpine House was erected in 1887—this being an innovation at the time; owing to its popularity it was enlarged in 1891 and re-built on a larger scale in 1939. Two other recent additions are of special note, one being the Sherman Hoyt Cactus House with its painted background of the Mohave Desert, which was presented by Mrs. Sherman Hoyt and completed in 1932, and the South African Succulent House, presented in 1935 in commemoration of the Silver Jubilee of King George V.

The lectures to the student gardeners were started by Sir William Hooker in 1859, and have been continued and much extended since then.

Two of the enterprises with which Kew has been intimately concerned and which have had far-reaching effects throughout the Empire are the introduction of Cinchona to India in 1861 and of Para Rubber to Malaya about 1876.

Various other enterprises, less spectacular, but of considerable importance, have taken place since those times. One of the functions of Kew has been to send plants of economic and horticultural value to all parts of the Dominions and Colonies, where conditions might be suitable for their cultivation. These have included Coffee (*C. liberica* and *C. stenophylla*); Pineapples; Mangosteen to the West Indies; Almonds collected in Majorca and sent to Cyprus; the Abyssinian Teff Grass, *Eragrostis abyssinica*, sent to South Africa; Tung Oil seeds (*Aleurites Fordii* and *A. montana*) to various suitable Colonies; Pelargoniums for their oil, to Kenya; Chaulmoogra (*Hydnocarpus*) to the West Indies and Malaya; *Artemisia* (a valuable source of Santonin) to various Colonies; *Derris*, *Pyrethrum*, *Lonchocarpus* and *Tephrosia* and other insectical plants to suitable places; Mahogany seed to India; Cricket-bat Willows to Canberra and elsewhere.

Among the most recent of these enterprises have been the sending of seeds of various species of *Passiflora* and plants of varieties of *Manihot* to Amani, in connection with the work being undertaken there to try and raise strains resistant to virus disease. Wild and cultivated Bananas have also been collected in the East and, after being propagated in the special quarantine house at Kew, have been sent to the Imperial College of Tropical Agriculture, Trinidad, in connection with the work that is being done there in breeding immune types to combat the Panama Disease of bananas, which is so seriously affecting the banana industry.

Kew is not only a place for healthy recreation and enjoyment, but it is also a garden for serious botanical study, and every effort is made to render the collections as educational as may be possible, both in their arrangement and by appropriate labelling. The tropical epiphytic ferns, for instance, have been planted out on

tree trunks much as they occur in their native forests ; and in the Tropical Fern House the effect of a tropical forest has been fairly successfully reproduced. Then again, both the Sherman Hoyt house and the South African succulent house display the plants growing among rocks similar in colour and nature to those among which they occur in their native countries.

For the botanical student there are the unrivalled collections in the Herbarium, Library, and Museums, the specimens in the Herbarium now numbering about 5,000,000 ; while the Jodrell Laboratory offers facilities for students who may wish to carry out physiological and other researches in connection with the specimens growing in the Gardens.

The various " Floras " of the Dominions and Colonies, the need for which was outlined by Sir William Hooker, have been prepared at Kew.

The work of Kew is pre-eminently scientific, but it is also possible for a non-scientific visitor to derive full enjoyment from the general beauty of the Gardens, for, though the trees and shrubs are mainly planted in their proper systematic order, the landscape effect has also been fully preserved.

To quote the words of Sir William Thiselton-Dyer—Kew " has itself grown and flourished under its past and present Chiefs . . . not so much from its dependence upon their merits, but rather because the principles of its administration have been essentially British and practical.

" It has steadily set itself to do every kind of public work which is connected with botanical science.

" It was never launched with a theoretically complete equipment and constitution, but it has slowly earned every advantage that has been conceded to it, and, as its labours have been enlarged, so its capacity for their performance has been increased."

X.—NOTES ON SACCHARUM AND ERIANTHUS SMUTS.

B. B. Mundkur (Imperial Agricultural Research Institute, New Delhi).

In a recent paper (1939), I have shown that the culmicolous smuts attacking species of the genera *Saccharum* and *Sclerostachya* comprise two species, *Ustilago scitaminea* Sydow and *U. consimilis* Sydow, and two varieties, *U. scitaminea* var. *Sacchari-Barberi* Mundkur and *U. scitaminea* var. *Sacchari-officinarum* Mundkur. The ovariicolous smuts attacking species of the genera *Saccharum* and *Erianthus* have now been investigated.

Cintractia pulverulenta *Cooke & Massee* apud *Cooke* in Grevillea, **18,** 34 (1889).

This species was described [loc. cit.] on an " *Erianthus* " collected by C. B. Clarke in Assam. The type specimen in Herb.

Kew. bears the name " *Sorosporium pulverulentum* Cke. and Mass.", but a portion of the same specimen in Massee's herbarium in the New York Botanic Garden is labelled " *Cintractia pulverulenta*," under which binomial the species was published. As Sydow (1924) had expressed a doubt regarding the identity of the host, the specimen was submitted to Dr. N. L. Bor, who states that, as the glumes are without awns, the specimen is a *Saccharum* and not *Erianthus*, which has the upper glumes awned, the only distinction separating it from *Saccharum*.

The genus *Cintractia* is characterised by the possession of spores agglutinated into a firm spore-mass. Sydow (1924) was unable to detect the spore-masses in the specimen of *C. pulverulenta* which he examined. He doubted if the smut had been correctly placed in that genus and Ciferri (1928) accordingly transferred it to *Ustilago*. Boedijn (1935), too, concluded that the fungus was not a *Cintractia* and again proposed its transfer to *Ustilago*, without knowing that this had already been done by Ciferri. Fragments from the portions of the type specimen, from Kew and the New York Botanic Garden, unmistakably show the presence of firm spore-masses. It is doubtful, therefore, whether Sydow (1924) and Ciferri (1928) had actually seen the type specimen before proposing the change. The specimen examined by Boedijn (1935) is not *Cintractia pulverulenta* Cooke and Massee, but *Ustilago Courtoisi* Ciferri.

That Cooke and Massee had correctly placed the smut in *Cintractia* will be manifest on an examination of their specimen. The sori do not have a false membrane ; a columella is present and the spores are agglutinated into a firm spore-mass which breaks up into smaller portions resembling spore-balls after some pressure has been applied. A revised description follows :—

Cintractia pulverulenta Cooke and Massee.

Ovariicolous, ovaries swollen into black hard masses, at first compact but later powdery. A tapering columella, around which the spore-mass is formed, present in the centre of the sorus. Spores globose to subglobose, Vandyke Brown (Ridgway) ; diameter 7·8 to 13·4μ with a mean of 10·4μ ; thin-walled, with a smooth edge, granular contents and a minutely pitted spore-surface.

On *Saccharum* sp. (originally identified as *Erianthus*) at Nungklao (4,250 ft.), Khasi Hills, Assam ; collected by *C. B. Clarke* (44069), May 28, 1886 (type). So far as I have been able to learn this smut has not been collected since in any locality. Such names as *Cintractia pulverulenta* as used by Rostrup, the *Ustilago pulverulenta* of Boedijn and presumably also the *U. pulverulenta* of Ciferri refer to different smuts.

Ustilago Courtoisi *Ciferri* in Ann. Mycol., **29**, 71 (1931).

This smut was collected on *Saccharum* sp. by Prof. F. Courtois in China, and was named by Ciferri, who kindly sent a fragment of

the type for comparison with the Indian collections. Some of the specimens formerly identified as *Cintractia pulverulenta* belong to this species. The description follows :—

Ovariicolous, all the ovaries in an ear attacked ; immature ovaries conically acuminate, slightly hypertrophied, 2 to 3 mm. long, blackish, emerging through half-open glumes and opening by bursting of the tegument, exposing dark brown, dusty spore-masses. Spores spherical to subpolyhedral, Prout's Brown (Ridgway) ; diameter 8·2 to 12·0μ with a mean of 9·8μ ; epispore slightly darker, 1 to 1·5μ thick, smooth to slightly punctate but not echinulate.

On *Saccharum* sp. in Ngau-Hoei, Zi-Ka-Wai, Chang-Hai prov. China ; collected by *F. Courtois*, August, 1928 (type). Also on *S. arundinaceum* Retz. in India, Burma, and Java.

1. Typus ex Herb. R. Ciferri.

Diameter	μ	8·2	9	10	11	12	
Frequency	n	11	57	103	27	2	= 200

Mean = 9·8μ

2. On *S. arundinaceum*, Upper Burma (Abdul Khalil), 1893 ; from a phanerogamic sheet, ex Herb. Roy. Bot. Gard., Calcutta. (Material very scanty.) Range 8·0 to 12·3μ with a mean of 9·9μ.

3. On *S. arundinaceum* at Bolampatti, India, 1912. Ex Herb. Crypt. Ind. Orient., labelled "*Cintractia pulverulenta*."

Diameter	μ	7·6	8	9	10	11	11·8	
Frequency	n	3	25	55	94	20	3	= 200

Mean = 9·7μ

4. On *S. arundinaceum* at Tiruvadi, India, January, 1912 ; from the Mycologist, Coimbatore, labelled "*Cintractia pulverulenta*" [det. Sydow (1914)].

Diameter	μ	7·8	8	9	10	11	12	
Frequency	n	1	26	43	114	14	2	= 200

Mean = 9·8μ

5. On *S. arundinaceum* at Tasikmalaja, Java, February, 1921. From K. B. Boedijn, ex Herb. Bog., labelled "*Ustilago pulverulenta*" [*see* Boedijn (1935)].

Diameter	μ	7·9	9	10	11·3	
Frequency	n	1	32	56	11	= 100

Mean = 9. 8μ

The smut resembles *C. pulverulenta*, but the spores are smaller and there is a complete absence of spore agglutination. The colour of the spores on *S. arundinaceum* is a slightly lighter brown than is that of the spores of the type.

Sphacelotheca Sacchari (*Rabenhorst*) *Ciferri*, Flora Ital. Crypt. Ustilaginales, 262 (1938).

Among the plants collected by Dr. Haussknecht in Iran from 1864 to 1868 was a specimen of *Erianthus ravennae* (L.) Beauv. attacked

by a smut, to which Rabenhorst (1870) gave the name *Ustilago Sacchari*. The smut is ovariicolous, but the name was for a long time applied by mistake to the culmicolous smut on sugar-cane. Another ovariicolous smut, on *Saccharum ciliare* Anderss. (= *S. Munja* Roxb.), was collected by D. D. Cunningham in India and sent to Brefeld (1895), who named it *U. Sacchari-ciliaris*. An examination of portions of the type specimens of both these smuts kindly sent by Dr. E. Ulbrich of the Berlin Botanical Museum, indicates that the two smuts are one and the same species.

In a personal communication Dr. G. L. Zundel states that Dr. G. P. Clinton and he had come to the conclusion some years ago that *U. Sacchari-ciliaris* should be placed in the genus *Sphacelotheca*. An examination of its type specimen, of Sydow's Ustilagineen No. 385, and of other collections in Herb. Crypt. Ind. Orient. shows that the sorus, much enlarged, is covered by a peridium which ultimately flakes away exposing the spores and a long, tapering columella. However, as this smut agrees completely with *U. Sacchari*, which also shows a peridium and a columella, its name should be *Sphacelotheca Sacchari*, as already proposed by Ciferri (1938).

Sphacelotheca Sacchari (Rabenh.) Ciferri.

Ovariicolous, ovaries elongated. Sori at first enclosed by a false membrane made up of fungus tissue, which later flakes away exposing dusty spore-masses. Columella tapering, nearly or quite as long as the sorus. Spores not agglutinated, free, more or less spherical to oblong, Sudan Brown (Ridgway), smooth to finely punctate ; diameter 7·1 to 10·8μ with a mean of 8·5μ ; epispore thin, edge smooth.

On *Erianthus ravennae* (L.) Beauv. (= *Saccharum ravennae* (L.) Murr.) at Marasch, Iran ; collected by *Haussknecht* (type). Also on *S. Munja* Roxb. (= *S. ciliare* Anderss.) and *S. arundinaceum* Retz. in India and Malaya. Syn. *Ustilago Sacchari-ciliaris* Bref.

6. *Typus*, ex Herb. L. Rabenhorst in Berlin Botanical Museum on *Erianthus ravennae* (L.) Beauv. (= *Saccharum ravennae* (L.) Murr.).

Diameter	μ	6·7	7	8	9	10	10·8	
Frequency	n	11	28	37	92	30	2	= 200

Mean = 8. 5μ

7. On *S. ciliare* Anderss. [*S. Munja* Roxb.] at Calcutta, India (*Cunningham*) ; ex Herb. Oscar Brefeld in Berlin Botanical Museum. Type of *U. Sacchari-ciliaris*.

Diameter	μ	6·5	7	8	9	10	10·8	
Frequency	n	1	43	48	70	36	2	= 200

Mean = 8. 5μ

8. On *S. ciliare* [*S. Munja*] at Cawnpore, India (*Butler*), 19–2–1907 ; ex Herb. Crypt. Ind. Orient., labelled " *Ustilago Sacchari-ciliaris.*"

Diameter	μ	7	8	9	10	10·8	
Frequency	n	18	71	78	31	2	= 200

Mean = 8·5μ

9. On *S. ciliare* [*S. Munja*] at Muzaffarpur, India, 21–4–1907 ; ex Herb. Crypt. Ind. Orient., labelled " *U. Sacchari-ciliaris.*"

Diameter	μ	6·8	7	8	9	10	10·7	
Frequency	n	8	26	35	104	26	1	= 200

Mean = 8·5μ

10. On *S. arundinaceum* at Pekan, Pahang, Malaya (*H. N. Ridley*) May, 1890 ; from a phanerogamic sheet, ex Herb. Roy. Bot. Gard., Calcutta. Range 6·8 to 10·8, mean = 8·5μ.

Sphacelotheca Erianthi (*Sydow*) *Mundkur*, comb. nov.

This smut on *Erianthus ravennae* was collected by J. Bornmüller in Turkestan and named by Sydow (1915) *Ustilago Erianthi* Syd. The inflorescence, which normally is 1 to 2 feet long was, according to Sydow, deformed into a club-like structure, barely 4 to 6 inches in length. A fragment of the type specimen kindly obtained for me by Mr. S. F. Ashby from Herr H. Sydow indicates that the smut is a *Sphacelotheca*, as the sorus possesses both a peridium and a columella.

Sphacelotheca Erianthi (Sydow) Mundkur.

Ovariicolous, ovaries slightly swollen ; at first covered by a false membrane made up of fungus tissue, which later flakes away revealing dark, powdery spore-masses and a slightly tapering columella in the centre of the sorus. Spores globose to subglobose, Mahogany Red (Ridgway), finely punctate with granular contents ; diameter 4·8 to 8·6μ with a mean of 6·5μ ; epispore thin, edge smooth.

On *Erianthus ravennae* in Turkestan, Bokhara, Prov. Baldshuan ; collected, 10–8–1913, by *J. Bornmüller.*

11. Typus, ex Herb. H. Sydow, on *Erianthus ravennae.*

Diameter	μ	4·6	5	6	7	8	8·6	
Frequency	n	1	4	57	31	5	2	= 100

Mean = 6. 5μ

A specimen collected by Ove Paulsen during Lt. Olufsen's second Pamir Expedition in 1899, between Chiwa and Tshardshui near the river Oxus (Amu Darya), was determined as *Cintractia pulverulenta* Cooke and Mass. by Rostrup (1907). Sydow (1924) states that this smut is identical with his *U. Erianthi.* A portion of the specimen (No. 1876) kindly sent by the Director, Universitets botaniske Museum, Copenhagen, shows that the attacked ovaries

are considerably swollen. The dusty spore-masses are covered by a peridium, and a prominent columella occupies the centre of the sorus. The spores possess a thick epispore whose surface and edge are smooth, but the spore contents are granular, giving the spores a pitted appearance. The diameter of the spores is 7·4 to 10·0μ with a mean of 8·9μ. The absence of spore agglutination excludes it from *Cintractia* and the spore morphology shows that it is not *U. Erianthi*. The smut is a *Sphacelotheca* but its determination is not possible in the absence of the name of the host.

Two specimens of the ovariicolous smuts from Herb. Kew. resemble *S. Erianthi* in many respects. The material consists of three or four sori each, in all of which a peridium and a columella are distinguishable. The spores are globose to subglobose; the epispore is thin and the edge smooth, but the spore surface is almost smooth to slightly rough in these specimens, whereas in *S. Erianthi* it is finely punctate. The spores are also larger. Pending examination of more material these smuts are referred to *Sphacelotheca Erianthi*.

12. On *Saccharum* sp. collected at Lahore, India, May 5, 1865 (*Dr. Stewart*) ex Herb. M. C. Cooke, ex Herb. Kew., labelled "*Ustilago segetum*." Range 5·9 to 9·3μ with a mean of 7·2μ.

13. On *Saccharum* sp. near Soane river; collector's name and date not stated. Ex Herb. Berkeley, No. 4744a, ex Herb. Kew., labelled "*Ustilago carbo* Tul. var." Range 5·6 to 9·3μ with a mean of 7·1μ.

Ustilago microthelis *Sydow* in Ann. Mycol., **22,** 280 (1924).

This smut was collected by E. Ule on *Erianthus asper* Nees at Itajahy, Brazil, and determined as *Ustilago Sacchari* Rabenhorst by Hennings (1896). Because of its densely verrucose spores and larger spore size, Sydow (1924) rightly thought that determination incorrect and founded a new species, *Ustilago microthelis*, to accommodate it. A fragment of the type specimen was kindly obtained for me by Mr. S. F. Ashby from Herr H. Sydow. The revised description is as follows:—

Ovariicolous, entirely destroying the ovaries; spore-masses exposed, powdery, black. Spores globose to subglobose, some elliptical, Chestnut (Ridgway), densely but minutely verrucose; diameter 7·9 to 12·6μ with a mean of 10·5μ; epispore thin with spiny edge.

On *Erianthus asper* Nees [= *Saccharum asperum* (Nees) Steud.] at Itajahy, Brazil; collected by *E. Ule* in November, 1885 (Type).

14. On *Erianthus asper*, ex Herb. Sydow, Type.

Diameter	μ	7·9	9	10	11	12	12·6	
Frequency	n	5	12	35	33	11	4	= 100

Mean = 10·5μ

A Smut on Erianthus capensis Nees.

In the folder of *Ustilago Sacchari* Rabenhorst at Herb. Kew. is a smut on *Erianthus capensis* collected by W. Saxton at Transkei, Cape Colony, South Africa. The smut was named *Ustilago gigaspora* by Massee, which is only a herbarium name, as it has not so far been effectively published. The material sent to me consists of a single considerably swollen ovary. The spore-masses are enclosed in a firm, brownish membrane but there is no columella in the sorus. The spores are powdery, elliptical to polyhedral, with a medium thick epispore and a smooth edge and surface. The spores are Prout's Brown (Ridgway) in colour, the epispore being slightly darker. Measurements of 50 spores gave a range of 13·0 to 21·5μ and a mean of 17·3μ. I am inclined to consider this as an undescribed species of *Tilletia*, none of which has so far been reported on the *Saccharum* group. Without an examination of more material, however, I hesitate to say more.

A Smut on Saccharum Munja Roxb.

In 1935 L. S. Subramaniam collected at Cuttack, India, a smut on *Saccharum Munja* which he identified as *Cintractia pulverulenta*, but he was presumably not sure of the identification, for on the label he has also written " ? *Sorosporium*." The smut is undoubtedly a new *Sorosporium*, for which I propose the name *Sorosporium indicum*.

Sorosporium indicum *Mundkur* spec. nov.

Ovaria incolens ; plurima inflorescentiae ovaria aggrediens. Adsunt membranae vestigia. Sporarum massa centralem circa columellam, quae est fastigata glumisque breviter longior. Sporarum glomeruli oblongi vel irregulariter ovati, nigri, 130·2–50·4μ longi et 79·8–33·6μ lati, medii inter minimos maximosque 89·5–58·8μ. Sporae ovales vel globosae, Antique Brown (Ridgway), leves, diametro 6·5 ad 9·6μ, mediae inter maximas minimasque 7·9μ, episporium tenue.

Habitat *Saccharum Munja* Roxburgh, Cuttack, Indiae orient. ; legit *L. S. Subramaniam*, die 22 Novembris, 1935. Specimen exemplarum in Herb. Crypt. Ind. Orient. in Herb. Imp. Mycol. Inst. et Herb. Kew.

Ovariicolous ; most of the ovaries in the inflorescence attacked. Vestiges of a membrane present. Spore-masses round a columella which is tapering and slightly longer than the glumes. Spore-balls oblong or irregularly egg-shaped, black, 130·2 to 50·4μ in length and 79·8 to 33·6μ in breadth with a mean of 89·5 × 58·8μ. Spores oval to globose, Antique Brown (Ridgway), smooth ; diameter 6·5 to 9·6μ with a mean of 7·9μ ; epispore thin.

On *Saccharum Munja* Roxb. at Cuttack, India ; collected by L. S. Subramaniam, November 22, 1935. Type specimen deposited in Herb. Crypt. Ind. Orient. Herb. Mycol. Instit., Kew, and Herb. Kew.

15. Type. On *Saccharum Munja*.

Diameter	μ	6·5	7	8	9	9·6	
Frequency	n	4	82	85	26	3	= 200

Mean = 7·9μ

Discussion.

Considerable confusion exists in the identification of the ovariicolous smuts affecting the genera *Saccharum* and *Erianthus*, primarily because the original descriptions were not precise and secondly because the determinations of the later collections were made without comparison with type or authentic specimens. This study shows how necessary is such a comparison, especially when changes in the generic position of the species are proposed. The generic name *Cintractia* has, in recent years, been restricted to smuts on the family Cyperaceae, but Cooke and Massee's fungus, even though it is on a graminaceous host, is so clearly a *Cintractia* that their judgment in placing it in that genus cannot be doubted.

The disagreement among agrostologists regarding the classification of the genera *Saccharum* and *Erianthus* complicates the taxonomic position of the smuts attacking their species, but the distinction between these two genera, if any, must be biologically very slight. At any rate, the same species of smuts seem to attack species of either genus.

The ovariicolous smuts affecting these genera are not as important economically as the culmicolous smuts, which are responsible for much damage to the sugar-cane crop.

Summary.

Eighteen specimens, six of them portions of type collections, of the ovariicolous smuts attacking species of the genera *Saccharum* and *Erianthus*, have been critically studied. *Ustilago pulverulenta* has been found to be a good *Cintractia* as was originally determined by Cooke and Massee and the name proposed by them, *Cintractia pulverulenta*, is retained after an examination of the type specimen. The host of this smut, formerly stated to be an *Erianthus*, has been re-determined as a species of *Saccharum* by Dr. N. L. Bor. The smuts determined by Sydow as *C. pulverulenta* and by Boedijn as *U. pulverulenta* are *Ustilago Courtoisi* Ciferri. *U. Erianthi* Sydow is transferred to the genus *Sphacelotheca*. A smut on *Saccharum Munja* is proposed as a new species, *Sorosporium indicum*. A smut on *Erianthus capensis* is evidently an undescribed species of *Tilletia* but the material I have is so scanty that final judgment on it is postponed until more material becomes available.

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[Since this paper was prepared for publication an inflorescence of sugar-cane, *Saccharum officinarum* L., affected by *Sphacelotheca Sacchari* (Rabenhorst) Ciferri, has been collected at Muzaffarpur, Bihar. B.B.M.]

XI.—CONTRIBUTIONS TO THE FLORA OF TROPICAL AMERICA: XLV.*

New plants from the Andes of Venezuela and Colombia.
N. Y. Sandwith.

The following descriptions are of striking new plants discovered by Mr. John Hanbury-Tracy on a recent collecting expedition in 1938–1939 to the Andes of Venezuela and Colombia. Owing to war conditions it has, as yet, been possible to determine only about half of the collection. Mr. Hanbury-Tracy and his wife camped for some months in the latter half of 1938 and early in 1939 on the Venezuelan Andes of Merida, and were able to visit a large number of paramos at least one of which, the Paramo de Molina at the eastern end of the Sierra, was botanically unexplored. The result is a valuable accession to the Kew Herbarium, which was weak in sets of the older collectors from Europe such as Moritz and Funck and Schlim, who had previously visited this region, and had only a scanty representation of the extensive modern gatherings of Drs. Pittier and Jahn who were resident in Caracas. Among the additions which Mr. Hanbury-Tracy has made to the Kew collections are the magnificent Melastomaceous species *Centronia pulchra* Cogn., *Begonia meridensis* A.DC., *Niphogeton ciliatum* (Wedd.) Rose ex Pittier, *Erigeron blepharophyllus* Blake, *Gnaphalium paramorum* Blake and *Senecio Funckii* Wedd. Outstanding is the abundant material of the remarkable genus *Espeletia*, the species of which—known locally as "Frailejones" because of the resemblance of their woolly leaves to priests' vestments—are the Andine counterpart of the African tree-Senecios. Mr. Hanbury-Tracy collected eleven species, viz. *E. neriifolia* (H.B.K.) Wedd., *E. marcescens* Blake, *E. Lindenii* Wedd., *E. banksiifolia* Wedd., *E. atropurpurea* A. C. Smith, *E. Weddellii* Wedd., *E. Moritziana* Wedd., *E.* "*spicata* Wedd." of A. C. Smith's revision, *E. elongata* A. C. Smith, the common *E. Schultzii* Wedd. and *E. pannosa* Standley. Of these *E. elongata* was a new species which Dr. Smith has described in Amer. Journ. Bot. xxvii. 546 (1940), *E. marcescens* and *E. banksiifolia* had been collected only once before, while the latter species, *E. atropurpurea* and *E.* "*spicata*" (it seems doubtful if Dr. Smith has interpreted Weddell's species correctly), were additions to the Kew Herbarium. The collector's field-notes are of importance to students of the genus since they show conclusively that both *E. marcescens* and *E. banksiifolia* are white-flowered species of tree habit, the former being 15 ft., the latter 20–30 ft. high.

In March 1939, Mr. and Mrs. Hanbury-Tracy moved into Colombia and collected on the low-lying Goajira Peninsula, for more than three months on the Sierra Nevada de Santa Marta, and on the Cordillera Central in the neighbourhood of Tolima, where their activities came to an end with the outbreak of the war. In Colombia

* Continued from K.B. 1940, 304.

they found two more species of *Espeletia*, *E. glossophylla* Matlf. (the endemic of the Sierra Nevada de Santa Marta) and *E. Hartwegiana* Cuatrecasas.

The following is a sketch of the itinerary :

August 11th–September 1st, 1938. From Merida, **Venezuela :** to Paramo del Tambor, including camp at Bocono and La Playa, *en route*.

September 6th–October 1st, 1938. From Merida : to Paramos de Conejos, de Campanerio and de Albarregas.

October 12th–November 14th, 1938. From Merida : to Paramos de Acequias, de Mucutuy, de las Lajas, de San José, del Molino.

November 23rd–December 29th, 1938. From Timotes : to Paramos de Niquitao, de Piñango and de Mucuchies.

January 10th–February 3rd, 1939. From Merida to Paramo de Molina.

March 12th–14th, 1939. From Merida to Maracaibo.

March 17th–27th, 1939. In Goajira Peninsula, **Colombia.**

April 4th–July 10th, 1939. On Sierra Nevada de Santa Marta.

August, 1939. On Tolima range, Cordillera Central.

GERANIACEAE.

Geranium Tracyi sp. nov. ; foliorum ambitu *G. multicipiti* Turcz. affinis a cujus formis adhuc ab auctore visis habitu indumentoque distinguitur.

Herba perennis, caulibus decumbentibus vel prostratis gracilibus ad 35 cm. longis, pilis brevibus simplicibus eglandulosis patentibus vel subdeflexis dense molliter pubescentibus, dimidio inferiore ob foliorum lapsum longe nudis, basi super rhizomate vel caudice stipulis persistentibus brunneo-rubris apice flexuoso-subulatis ad 1 cm. longis praeditis, dimidio superiore foliosis floriferisque, scilicet folia opposita pedunculum biflorum (unicus tantum ramulus lateralis dichasii cujusque evolvitur) subtendentia gerentibus ; internodia inferiora 10–15 cm. longa. *Stipulae* brunneae, lanceolatae, apice subulatae, ciliatae, ad 5 mm. longae. *Folia* basalia non visa ; caulina ambitu semicircularia, 2–3 cm. diametro, ad medium vel paulo ultra medium 5-partita, lobis oblongis vel obovato-oblongis 4–8 mm. latis omnibus (lateralibus extimis profundius) inaequaliter 2–3-lobulatis, lobulis obtusis calloso-mucronatis, coriacea marginibus revolutis, supra pilis rigidiusculis copiose regulariter sed haud dense pilosa nervis canaliculato-immersis, subtus pallidiora pagina fere vel omnino glabra punctata nervis valde prominentibus conspicue pilosis ; petiolus indumento caulis molliter indutus, 2–7·5 cm. longus, foliorum inflorescentiae summorum brevior. *Inflorescentiae* pedunculi indumento caulis eglanduloso induti, 2·5–7 cm. longi, apice bracteati ; bracteae lineari-lanceolatae, molliter pubescentes, 5 mm. longae ; pedicelli eodem indumento densius induti, 1–4 cm. longi. *Sepala* oblonga, obtusa, apice brevissime calloso-mucronata, 5–7·5 mm. longa, 2–2·75 mm. lata, pilis patulis vel subadpressis simplicibus eglandulosis satis dense molliter pubescentia. *Petala*

lilacina vel alba, sepalis plus minusve duplo longiora, obovato-spathulata, 1·15 cm. longa, ad 6·5 mm. lata. *Stamina* inaequalia, vix ad 6 mm. longa ; filamenta dimidio inferiore ciliata vel nonnulla glabra. *Ovarium* pilis simplicibus patulo-ascendentibus dense pubescens. *Carpidia* similiter induta, 3·5 mm. longa, rostris patule pubescentibus circiter ad 1·5 cm. longis.

Venezuela. Merida : Paramo del Tambor, in open paramo among grasses, herbs and undershrubs, 2820 m., August 23rd, 1938, *J. Hanbury-Tracy* 50. " Straggling, often prostrate on ground. Flowers mauve-pink, pink or white." Vernacular name, " Aroma."

This plant, characterised by its habit and leaves, and by the spreading eglandular indumentum of the stems and inflorescence, seems to fit into none of the species described from this region by Turczaninov, or more recently by R. Knuth, Standley, Blake and Pittier. It must be confessed, however, that thorough field-investigation may prove that *G. multiceps* Turcz. is a very variable species embracing many forms differing in their habit, the shape of their leaves, and the amount and direction of the indumentum of various parts. Meanwhile, the plant described above presents a combination of characters which is matched in none of the forms which have been examined. At the moment no collection has been seen which exactly matches the type number (*Funck and Schlim* 861, from Venezuela) of *G. multiceps*. The specimen of this number in the British Museum Herbarium agrees well with Turczaninov's description except that the leaves are hardly " utrinque pube adpressa vestitis " : rather, they are glabrescent with ciliate margins, and with the main veins of the lower surface sometimes, but apparently not always, obscurely pubescent. A notable feature of this specimen is the extremely short, closely downward-adpressed pubescence of the stems, petioles, peduncles, pedicels and sepals, which is unmatched in other material, including *Moritz* 1247 from Venezuela, which has been referred to *G. multiceps*. Thus also, the distinctive plant which is common around Bogotá in Colombia and has been identified with *G. multiceps* by all authors since Triana is certainly not the " typical " form of that species, whatever other relationship it may bear to it.

Apart from *G. multiceps*, the other possible allies described from the Merida region, *G. subnudicaule* Turcz. and *G. velutinum* Turcz., differ from *G. Tracyi* in the shape and toothing of the leaf-lobes, while the former also has a glandular-pilose inflorescence, and the latter—according to the description—has subsessile or shortly pedunculate pedicels. This conspicuously glandular-pilose indumentum of the pedicels and sepals is an important character of the type collection (*Funck and Schlim* 1127 in Herb. Mus. Brit.) of *G. subnudicaule* which was not mentioned by Turczaninov : account will have to be taken of it in relating the species to certain others which have been described in recent years. Similarly, the type collection (*Linden* 1394 in Herb. Kew.) of *G. Lindenianum* Turcz.

has a glandular-pilose inflorescence. That of *G. velutinum* (*Funck and Schlim* 1251) has, unfortunately, not been seen and is presumably not represented in Britain.

Leguminosae.

Lupinus verbasciformis sp. nov.; *L. venezuelensi* C. P. Smith atque *L. alopecuroidi* Desr. affinis, ab illo petiolis longe villoso-lanatis foliolis 10–11 latioribus oblanceolatis planis racemo longissimo pedunculo deflexo-villoso, ab hoc statura magnitudine foliorum racemo pro rata tenui statim distinguitur.

Herba perennis, circiter 5 dm. alta, basi valde foliifera ibique caules juniores in exemplo unico viso brevissimos emittens; caulis principalis fistulosus, 8–9 mm. diametro, pilis albis longis deflexis laxe villoso-lanatus. *Stipulae* inferne dilatato-adnatae, parte libera lineari-filiformi circiter 1·5 cm. longa. *Folia* 5–10 cm. longa incluso petiolo ad 7 cm. longo pilis deflexis longe laxe villoso-lanato; foliola 10–11, anguste oblanceolata, apice obtusa vel acuta et abrupte brevissime mucronato-cuspidata, basin versus sensim attenuata, maxima vix 3 cm. longa, ad 7 mm. lata, plana, supra satis laxe adpresse pilosa, subtus copiosius villosa et laxe lanata. *Pedunculus* 7·5 cm. longus, indumento caulis vestitus. *Racemus* unicus visus fere 33 cm. longus, 3 cm. tantum diametro, apice comoso-bracteatus, verticillis circiter 15, quorum imis internodiis 2–3 cm. longis sejunctis, ceteris approximatis internodiis brevibus sub bracteis calycibusque undique dense albo-lanatis vix cernendis; bracteae filiformes, persistentes, plerumque flexuosae vel recurvae, 1–2·2 cm. longae; pedicelli albo-villosi, 4–5 mm. longi. *Flores* ascendentes. *Calyx* extra longe albo-lanato-villosus, 1·2 cm. longus; labium superius profunde ultra medium bifidum, lobis lanceolatis 8–8·5 cm. longis basi fere 2·5 mm. latis; inferius concavum, lanceolatum, apice tridentatum, 9 mm. longum, basi fere 3 mm. latum. *Petala* intense caerulea, paginis glabra; vexillum 1·25 cm. longum, 1 cm. latum, dorso conspicue carinatum carina apice basique dilatato-alata praeterea apice apiculatum; alae 1·5 cm. longae, 7 mm. latae; carina 1·5 cm. longa, marginibus superioribus ciliatis. *Ovarium* longe lanato-villosum. *Legumen* non visum.

Venezuela. Merida: Paramo de Campanerio, c. 4000 m., September 14th, 1938, *J. Hanbury-Tracy* 91. "In open paramo, among herbs, grasses and undershrubs, in close association with *Frailejones* (*Espeletia* spp.). Rare. Height about 18 inches. Flowers deep blue." Vernacular name, "Chocho del paramo."

Only a single lupin, *L. ramosissimus* Benth., had been recorded from Venezuela up to the year 1927 when R. Knuth compiled his *Initia Florae Venezuelensis*. In October, 1938, however, Dr. Charles Piper Smith began his paper no. six of the series "Species Lupinorum", devoting it to the genus *Lupinus* in Venezuela. On the completion of this paper in February, 1939, eleven species of lupin had been described and recorded from the Republic and a key was given by which to distinguish them. Mr. Hanbury-Tracy

collected two lupins on the Andes of Merida, *L. meridanus* Moritz ex C. P. Smith and the fine new species with a long, woolly, mullein-like raceme which is described above. This plant is clearly related to Dr. C. P. Smith's *L. venezuelensis* which is based on a collection made by Dr. Pittier on the Paramo de Timotes, near Merida; but it differs from it in a number of obvious characters, as can be seen from the diagnosis. It also bears an interesting resemblance to the giant *L. alopecuroides* of the Andes of Colombia, Ecuador and Peru. *L. Lindenianus* C. P. Smith, from the evidence both of the description and of one of the cited collections (*Funck and Schlim* 1611, see specimen in Herb. Mus. Brit.), is of a wholly different affinity, having, *inter alia*, a much longer main stem below the inflorescence and a sericeous adpressed indumentum on the slender petioles and on the leaflets which are glabrous above, as well as lacking the remarkable facies of the woolly raceme of Mr. Hanbury-Tracy's lupin.

MELASTOMACEAE.

Monochaetum uberrimum sp. nov.; in sect. *Grischowia* (Karst.) Triana grege *Lindenianae* Gleason ponenda, habitu robusto, ramis ramulisque inflorescentiae insigniter tetragonis costis angulorum elevatis, inflorescentiis uberrimis densissime multifloris valde distincta.

Suffrutex humilis; rami robusti, acute tetragoni subalati costis conspicue elevatis sed his decorticantibus demum inferne teretes, 4–6 mm. diametro, internodiis siccitate brunneis glabris vel parce plerumque adpresse rarius patule strigoso-pilosis, nodis longe inaequaliter setoso-pilosis. *Folia* ovato-elliptica, apice acute acuminata vel acuta, basi cuneata, maxima ad 4 cm. longa ad 1·7 cm. lata, firme chartacea, supra inter nervos et juxta margines lineis longitudinalibus leviter strigillosa, subtus secus nervos conspicue strigosa pagina ubique satis parce strigillosa, 5-plinervia addito etiam pari obscuro marginali, nervis supra impresso-canaliculatis subtus prominentibus; petiolus gracilis, conspicue strigosus, 4–6 mm. longus. *Inflorescentiae* uberrimae, densissime multiflorae, repetite ramuloso-cymosae, ramulis rigidis tetragonis intricatissimis atque siccitate superpositis, apice 5–12 cm. latae, glabrescentes vel glabrae; pedicelli graciliores, 5–8 mm. longi vel illi florum cymarum ultimarum lateralium breviores, parce strigosi. *Hypanthium* ovoideo-oblongum, 6 mm. longum, 3·5 mm. diametro, super ovario constrictum et 2 mm. ultra elevatum, parce strigosum, demum glabrum sed apice ipso parce setosum, rubro-tinctum. *Sepala* ovata, acuminata, 6–6·5 mm. longa, 2·75–3·5 mm. lata, glabra, ciliata, apice haud setosa, rubro-tincta. *Petala* carminea, obovata, 1·1–1·3 cm. longa, 8 mm. lata. *Stamina majora* filamentis 7·5–8 mm. longis, antheris 1–1·05 cm. longis, appendicibus 5·5–7 mm. longis triente inferiore filiformi-filamentiformi trientibus duobus superioribus concavo-cymbiformibus rugulosis margine sinuatis sursum subintegris longe attenuatis vel irregulariter 3-lobis lobo intermedio terminali longo lobis lateralibus plerumque brevibus vel brevissimis

rotundato-obtusis. *Stamina minora* filamentis 8·5–9 mm. longis, antheris 5·2–6 mm. longis, appendicibus his aequilongis vel fere aequilongis oblongo-lanceolatis apice longe (ad 1·5 mm.) attenuato-acuminatis basi in unguem complanatum attenuatis. *Ovarium* apice setosum; stylus 1·5–1·6 cm. longus.

Colombia. Sierra Nevada de Santa Marta: Surivaquito, on open paramo, 3000 m., April 22nd, 1939, *J. Hanbury-Tracy* 316. "Undershrub 2 ft. high. Flowers carmine."

The staminal characters of this interesting plant seem to disturb Dr. Gleason's key for distinguishing his two groups, *Lindenianae* and *Humboldtianae*, of the section *Grischowia* (see Amer. Journ. Bot. xvi. p. 509), since the filaments of the two series are subequal while the appendages of the smaller series are usually quite as long as the anthers; but there seems to be little doubt that its affinity is with the *Lindenianae* rather than with the other group which, up to the time of writing, is known only from Venezuela. The nearest allies are evidently *M. meridense* (Kl.) Naud. and *M. laxifolium* Gleason, the former of which occurs both in Colombia and Venezuela while the latter, on present evidence, is an endemic of the Sierra Nevada de Santa Marta. *M. uberrimum* is immediately distinguished from both species by the robust habit with thick strongly tetragonous branches, and by the very remarkable inflorescence; it approaches *M. meridense* in the dimorphic anthers and *M. laxifolium* in the long style, but presents an entirely new combination of floral characters.

Begoniaceae.

Begonia (§ *Casparya*) **formosissima** sp. nov.; *B. montanae* (DC.) Warb. affinis, floribus maximis speciosissimis, praeterea magnitudine stipularum bractearum antherarum, connectivo harum in laminam conspicuam multo longius producto primo visu distinguitur.

Herba fruticosa, teste lectore repens; caules elongati foliosi, ex axillis foliorum ramulos breves pilosos folia ipsa paulo superantes emittentes, glabri vel sub nodis obscure lineatim pilosi, sulcati, 2–3 mm. diametro; internodia 2·5–6·5 cm. longa. *Folia* eis *B. montanae* similia, ovata, apice acute acuminata, basi valde obliqua latere altero ambitu attenuato sed basi ipsa revera rotundato-auriculato altero majore conspicue late rotundato et demum super petiolo breviter auriculato, 3–5·5 cm. longa, 1·6–2·8 cm. lata, tenuiter chartacea, opaca, dupliciter serrata dentibus setis terminatis, supra ut in *B. montana* pagina inter nervos setis sparse adpresse pilosa, subtus pallidiora secus nervos pilosa ceterum glabra, nervis utroque costae latere 6–7 supra planis vel impressis subtus conspicuis; petiolus vulgo 1–1·5 cm. longus, superne aliquantum pilosus. *Stipulae* oblongae, mucronatae, fimbriato-dentatae, 1–1·4 cm. longae, 4–6 mm. latae, secus ramulos aliquantum minores. *Pedunculi* folia superantes, 5·5–11·5 cm. longi, graciles, glabri, apice 2–3-flori, scilicet dichasii florem terminalem cymulamque lateralem unicam 1–2-floram gerentes; bracteae obovato-oblongae, magnitudine

stipularum, illae cymulae lateralis 1–2-florae minores multo angustiores ; pedicellus floris terminalis 3·5–5 cm. longus, florum lateralium brevior. *Flores* masculi tantum visi, formosissimi, intense scarlatini, 8–9·5 cm. diametro ; alabastra sub anthesi anguste elliptico-oblonga, 3·2–3·7 cm. longa. *Tepala* 4, glabra ; exteriora oblonga, 4·5–5 cm. longa, 1·2–1·8 cm. lata ; interiora (petala) spathulato-oblonga, basin versus conspicue contracta angustata, exteriora superantia, ad 5·3 cm. longa, 2–2·6 cm. lata. *Stamina* libera, circiter 40 ; filamenta brevia, 2–3·2 mm. longa ; antherae filamentis multo longiores, anguste lineari-oblongae, 7·5–9·5 mm. longae, connectivo in laminam foliaceam anguste oblongam vel spathulato-oblongam obtusam 3–4 mm. longam ad 1·2 mm. latam producto.

Venezuela. Merida : Paramo de las Lajas, Mucutuy, 2550 m., October 25th, 1938, *J. Hanbury-Tracy* 142. "Creeper, in thick woods 200 ft. below open paramo with high humidity. Flowers vivid scarlet."

In spite of the absence of female flowers and fruits I have little hesitation in placing this magnificent plant in the section *Casparya*, subsection *Sassea*, next to *B. montana* (DC.) Warb. which is also an endemic of the Sierra Nevada de Merida. The stems and foliage of the two species are remarkably alike, as are the general characters of the male flowers which, however, differ astonishingly in the size of the tepals and stamens and in the relative length and appearance of the produced portion of the anther-connective.

Compositae.

Culcitium rex sp. nov. ; *C. Panizzae* Dusc (*C. paramensi* Cuatr.) affinis, ramis multo crassioribus ubique persistenter lanatis, foliis multo majoribus reflexis vel patentibus basi haud cordatis praeterea distincte petiolatis petiolo circa caulem late vaginante, bracteis involucri exterioribus multo angustioribus, corollae structura statim distinguitur.

Frutex usque ad 2 m. altus ; rami robusti, teretes, 1–1·5 cm. crassi, ubique etiam inferne in parte defoliata dense adpresse albo-lanati. *Folia* per 15–22 cm. dense imbricata, inferiora reflexa, superiora patentia, crassissime coriacea, integra marginibus valde revolutis, oblonga vel oblongo-lanceolata vel lanceolata, apice cucullato-obtusa, basi in petiolum brevem rotundato-cuneata, 2·3–4 cm. longa, 0·6–1·7 cm. lata, supra glabra nisi basi lana detersili insigniter vestita valde nitentia atque vernicosa siccitate saturate brunnea costa vix vel anguste ac obscure canaliculato-impressa, subtus lana alba laxa detersili vestita praeterea tomento sordide albo-brunneo dense arcte induta costa crassa prominente ; petiolus circiter ad 3 mm. longus atque latus, lanatus atque tomentosus vel demum supra glaber, basi circa caulem latissime vaginans. *Capitula* compluria (ut videtur 6–8) apice ramorum in corymbum densum 3·5–7 cm. diametro aggregata, pedunculata ; pedunculi ad 1·5 cm. longi, densissime

villoso-lanati, fere nudi vel bracteis compluribus lineari-filiformibus 1–1·5 cm. longis praediti. *Capitulum* discoideum, homogamum, subglobosum, involucro campanulato, 1·8–2·2 cm. diametro. *Involucri* bracteae exteriores, scilicet bracteae calyculi irregularis inaequilongae pluriseriales, eis pedunculi similes ; summae interiores circiter 21, biseriales, fere aequilongae, exteriores paulo longiores, hae lineari-lanceolatae apicem versus conspicue attenuatae 1 cm. longae 2 mm. latae passim rigidae dorso anguste carinatae concavo-cymbiformes, interiores anguste elliptico-oblongae vix 1 cm. longae 2·75 mm. latae dorso crasse late brunneo-carinatae ceterum pallidae scariosae planiusculae, omnes obtusae basi lanatae superne ciliato-fimbriatae apice lanatae ceterum demum plus minusve glabrae. *Receptaculum* apice planiusculum, leviter tantum convexum, glabrum, leviter sed conspicue alveolatum conjunctionibus jugorum in denticulos acutos surgentibus. *Flores* ochroleuci, involucrum superantes ; corollae tubus 4 mm. longus ; limbus tubuloso-infundibuliformis, 3·5–5 mm. longus, profunde lobatus, lobis triangulari-lanceolatis obtusis 1·5 mm. longis enerviis apice calloso-incrassatis. *Stamina* filamentis 3·5 mm. longis ; antherae 3–3·2 mm. longae, corollae lobos paulo vel conspicue superantes. *Stylus* 1·05 cm. longus, ramis recurvis apice penicillatis, corollam longe superans. *Achaenia* lineari-oblonga, glabra, costata, immatura 3 mm. longa. *Pappus* albus, setis denticulatis corollam aequantibus.

Venezuela. Merida : Paramo de Conejos, 4000 m., September 25th, 1938, *J. Hanbury-Tracy* 151. " Shrub 5–7 ft. high, in open paramo among herbs, grasses and undershrubs, on rather dry soil. Flowers pale yellow."

The affinity of this splendid plant is apparently with *C. paramense* Cuatr. and *C. Panizzae* Duse, which present the same facies of leaves and capitula on a much smaller scale, but differ in the more obvious gradation of the broader outer involucral bracts as well as in other characters of the leaves and flowers. It is believed that these two species, both based on material from the summit of Mt. Tolima in Colombia, are conspecific in spite of small discrepancies between the descriptions ; and it seems evident that *Senecio crymophilus* Wedd., Chloris Andina, i. 95, also from the peak of Tolima, is a very close ally (this affinity was suggested by Cuatrecasas) and if actually conspecific will provide the earliest epithet for the plant. The types of all these species should be compared as soon as possible. The involucre of Mr. Hanbury-Tracy's plant shows how poor is the distinction between *Senecio* and *Culcitium* : the fact is that the outer rows of bracts are merely members of the " calyculus " placed at slightly different levels up the back of the receptacle, and in this instance they all differ markedly in breadth from those of the innermost series. *Culcitium* is by now a somewhat heterogeneous collection of discoid Andine species of *Senecio*, and this new Venezuelan shrub should be placed in it for the present on account of the apparent relationship with *C. Panizzae* (*C. paramense*) and *C. ovatum* (*C. reflexum*).

Senecio longepenicillatus nom. nov.—*S. nevadensis* Wedd., Chloris Andina, i. 97 (1856); R. Knuth, Initia Fl. Venez., in Fedde Rep. Sp. Nov. Beih. Band xliii. 730 (1928); Greenman in Ann. Missouri Bot. Gard. xxv. 810 (1938); *non S. nevadensis* Bss. et Reut. Pug. Pl. Nov. 60 (1852).

Venezuela. Merida: Paramo de la Culata, *Moritz* 1383; *ibid.*, *Jahn* 131a (fide Greenman); Paramo de Campanerio, September 19th, 1938, *J. Hanbury-Tracy* 98; Paramo de Piñango, Timotes, December 9th, 1938, *J. Hanbury-Tracy* 263.

A new name being required for this species, the above manuscript epithet of Schultz-Bipontinus, previously published only as a synonym of *S. nevadensis* Wedd. by Weddell, the Index Kewensis and Knuth, is now adopted and given legitimate status.

Senecio venezuelensis sp. nov.; *S. pachypo* Greenm. ex eadem regione descripto verisimiliter affinis, ramis glabris sed laccatis, foliis multo majoribus haud arcte crenatis sed argute serratis basi attenuatis, bracteis involucri longioribus, ligulis numerosioribus differt.

Frutex fere omnino glaber, usque ad 1·5 m. altus, satis intricate ramosus, ramis inferioribus ligneis nonnunquam elevatim suberoso-rugosis ad 1 cm. diametro; rami superiores juniores aggregati, cicatricibus crassis elevatis scilicet petiolorum delapsorum reliquiis notati; ramuli ultimi hornotini glabri sed lacca tenui membranacea alba facile detersili praecipue prope petiolorum bases notabili obtecti; internodia 0·5–2·5 cm. longa. *Folia* superne aggregata, elliptica, obovato-oblonga, obovata vel oblanceolata, apice acuta vel rotundata, basi in petiolum cuneate attenuata, 2–5·7 cm. longa, 1–2·7 cm. lata, patula, rigide coriacea, siccitate brunnea, oculo nudo glaberrima sed revera plerumque papillis albis linearibus irregulariter conspersa, trientibus duobus superioribus argute satis remote serrata dentibus utroque margine 7–8 patulis vel plus minusve porrectis 0·5–2·5 mm. latis papillis albis secus margines sparsis sed in sinibus confertis, supra lucida nervis sulcato-immersis pagina intricatissime rugulosa, subtus costa plana vel prominente nervis utroque latere 4–5 ascendentibus impressis pagina sub lente glandulis aurantiacis creberrime punctata; petiolus vulgo 1 cm. (0·5–1·5 cm.) longus, basi dilatatus atque nodoso-incrassatus. *Inflorescentia* corymbum terminalem simplicem vel basi cymosum satis densum sed paucicapitatum 4–7 cm. latum efformans, siccitate brunnea, oculo nudo glabra sed papillis raris conspersa atque lacca detersili hic illic notata; rami imi ad 4·5 cm. longi; bracteae conspicuae, linear-oblongae vel spathulato-oblongae, concavo-cymbiformes, 0·8–1·7 cm. longae, 1·5–3·5 mm. latae, margine papilloso-ciliatae, apice penicillato-lanatae, basi incrassatae; pedicelli 1–4 cm. longi. *Capitula* conspicue radiata, circiter 1·5 cm. alta, ligulis inclusis 2·5–3 cm. lata. *Involucrum* bracteis lineari-oblongis sese ipso aliquantum brevioribus calyculatum; bracteae involucri ipsius 12–13, lineari-oblongae, obtusae, 0·9–1 cm. longae, 1·5 (exteriores)–3·5 mm. latae, interiores marginibus late scariosis, apice penicillato-

lanatae, praeterea interiores dimidio superiore fimbriato-ciliatae, ceterum glabrae. *Receptaculum* apice valde convexum, profunde alveolatum atque conspicue denticulatum. *Flores radii* 8–13; tubus ad 5 mm. longus; ligula flava, siccitate vero supra laete pallide flava subtus brunnea, ad 1·2 cm. longa, ad 3·75 mm. lata, apice 2–3-lobulata. *Flores disci* 25–30; tubus circiter 2·5 mm. longus; lamina infundibuliformis, 3·5–3·75 mm. longa, lobis anguste deltoideo-ovatis 1·2 mm. longis antheris ramisque styli paulo superatis. *Achaenia* lineari-oblonga, glabra, costata, 2·75–3 mm. longa. *Pappus* albus, corollae tubum subaequans.

Venezuela. Merida: Paramo de Molina, Sierra Nevada, 4000 m., January 28th, 1939, *J. Hanbury-Tracy* 264. "Shrub 3–5 ft. high, in sheltered gullies in open paramo, in sparse thickets of scrub, grasses, etc. Flowers yellow."

This is presumably allied to *S. pachypus* Greenm., which was based on five different gatherings from the Merida region, one of the localities being the Paramo del Molino, which must not, according to Mr. Hanbury-Tracy, be confused with the Paramo de Molina. The writer is unable to assign Mr. Hanbury-Tracy's fine material to this species even as a variety, since *S. pachypus* is described as having stems tawny-pubescent with coarse stiff hairs; small leaves only 5–10 mm. long and 3–6 mm. broad, closely and regularly crenate-dentate, and abruptly contracted into a petiole only 1–2 mm. long; and involucral bracts only 4–5 mm. long. The only possible ally in Weddell's conspectus of the Andine Senecios is *S. subarachnoideus* Wedd. from which *S. venezuelensis* differs in the absence of arachnoid tomentum, relatively broader and more coriaceous leaves with deeply impressed nerves on the upper surface, and broader involucral bracts.

Senecio sancti–Sebastiani sp. nov.; *S. subarachnoideo* Wedd. affinis, sed tota planta indumento plerisque partibus persistente griseo-argenteo arachnoideo-lacciformi arcte induta, capitulis cum involucris ipsis fere dimidio minoribus late dense corymbosis, bracteis involucri paucioribus latioribus interioribus ovatis distinguitur.

Herba perennis fruticosa, ubique indumento supra descripto praedita, inferne ramosa; rami defoliati teretes 4–5 mm. diametro, ultimi floriferi ad 40 cm. longi, dense foliati, ramulos novellos foliatos foliis subaequilongos ex axillis gerentes. *Folia* oblanceolata, elliptico-oblonga vel obovato-elliptica, apice subacuta vel obtusa vel rotundata, basi in petiolum attenuato-cuneata, 2·5–5 cm. longa, 0·7–2·6 cm. lata (ea ramulorum novellorum minora), firme chartacea vel subcoriacea, indumento griseo-argenteo lacciformi subtus perconspicuo densissimo persistente supra nonnunquam laxiore et plus minusve detersili, trientibus duobus superioribus argute serrata dentibus utroque margine 2–7, vel subintegra, costa supra canaliculato-impressa subtus praesertim secus dimidium inferius prominente, nervis supra impressis haud cernendis subtus impressis vel primariis nonnunquam prominulis his utroque costae latere 3–5 ascendentibus;

petiolus satis gracilis, supra canaliculatus, 0·9–1·8 cm. longus, indumento saepe conspicue laminatim detersili. *Inflorescentia* polycephala, arcte dense corymbosa, parte florente 2–4 cm. alta 4–7 cm. lata, ramis imis 2–7 cm. longis, ubique indumento supra descripto hic illic nonnunquam detersili obtecta ; bracteae ramos subtendentes lineari-oblongae, imae ad 1·2 cm. longae, superne decrescentes. *Capitula* radiata, circiter 0·8–1 cm. alta, ligulis inclusis 1·5 cm. lata. *Involucrum* bracteis lineari-lanceolatis acutis 4 mm. longis vix ad 0·7 mm. latis calyculatum ; bracteae involucri ipsius 13–14, exteriores oblongo-lanceolatae, interiores ovatae, acuminatae, acutae vel interiores obtusae, 5 mm. longae, 1·8 (exteriores)–2·75 mm. latae, concavae, interiores marginibus late scariosis superne ciliolatis, apice penicillato-lanatae, ceterum extra lana laxa arachnoidea hic illic detersili indutae. *Receptaculum* apice convexum, conspicue alveolatum, glabrum, inconspicue denticulatum. *Flores radii* circiter 13 ; tubus 3·5–4 mm. longus, inferne arachnoideo-pubescens ; ligula flava, 6 mm. longa, ad 2·7 mm. lata, apice brevissime obscure lobulata. *Flores disci* numerosi, 60–70 ; tubus ad 1·5 mm. longus ; lamina tubuloso-infundibuliformis, 3·5–4 mm. longa, lobis deltoideo-ovatis ad 0·75 mm. longis, antheris styloque inclusis. *Achaenia* glabra, costata, circiter ad 1·75 mm. longa. *Pappus* albus, corollae tubum subaequans.

Colombia. Sierra Nevada de Santa Marta : Surivaquito, open paramo, 3000 m., April 22nd, 1939, *J. Hanbury-Tracy* 355 (typus) ; mountains of San Sebastian, July, 1844, *Purdie* ; San Sebastian, " 6 à 7000 ", fl. Jan., *Funck* 505 ; " Sierra Nevada ", Jan., 1917, *M. T. Dawe* 683, 714.

These five collections, all from the same district, represent a very distinct species which does not appear to have been recorded or described by Weddell, Greenman or other students of this genus.

XII.—CONTRIBUTIONS TO THE FLORA OF TROPICAL AMERICA : XLVI.

The Haiariballis of British Guiana. N. Y. Sandwith.

Alexa leiopetala sp. nov. ; *A. imperatrici* (Schomb.) Baill. affinis, ramulis junioribus necnon rhachi folii praecipue foliolis subtus ubique minute adpresse pubescentibus, calyce minore, colore petalorum inferiorum, petalis omnibus extra glabris neque trientibus duobus inferioribus conspicue sericeo-pubescentibus, antheris brevioribus, ovarii stipite per totam longitudinem tomentoso differt.—*A. imperatricis* (Schomb.) Baker in Hook. Ic. Pl. t. 1794 (1888) quoad tab., partim quoad descr.

Arbor mediocris vel alta ; ramuli hornotini minute arcte dense fulvo-pubescentes. *Folia* rhachi indumento simili minutissimo nonnunquam vix nisi sub lente forti cernendo vestita ; petioluli

similiter induti, 6–10 mm. longi ; foliola 9–13, oblonga vel oblongo-lanceolata, terminale nonnunquam obovato-ellipticum, apice conspicue anguste cuspidato-acuminata, basi rotundata vel obtusa et plus minusve cuneata, foliolum terminale acute cuneatum, 5·5–20 cm. longa, 2·3–6·2 cm. lata, tenuiter coriacea, supra glabra, subtus dense arcte minutissime pubescentia indumento nunc obvio nunc oculum nudum eludente et sub lente forti tantum distinguendo, nervatione ei *A. imperatricis* subsimili sed reticulatione saepius minus prominula. *Racemi* infra folia e ramulis vetustis nudis exorientes, 5–10 cm. longi, densiflori, ubique indumento minuto subsericeo siccitate fusco-pullo arcte tomentosi ; bracteae tempore florendi persistentes, ovatae, acuminatae, concavae, ad 4 mm. longae, basi circiter 3 mm. latae : pedicelli inferiores ad 3 cm. longi, saepius plus minusve nutantes, superiores gradatim breviores. *Alabastra* matura ellipsoidea vel obovoideo-ellipsoidea, 1·2–1·5 cm. longa, 0·8–1·2 cm. diametro. *Calyx* campanulatus, irregulariter fissus atque lobatus, 1·3–1·8 cm. longus, apicem versus 1·5–2·5 cm. latus. *Petala* glabra, scarlatina, apice aurantiaca ; vexillum obovatum, dimidio superiore conspicue reflexo, apice profunde late bilobum, 3·5 cm. longum, apicem versus circiter 3·2 cm. latum ; petala cetera 4 elliptico-oblonga vel anguste obovato-oblonga, obtusa, 2·9–3 cm. longa, 0·75–1·2 cm. lata. *Stamina* glabra, filamentis scarlatinis 3–4 cm. longis, antheris aurantiacis 4–4·5 mm. longis. *Ovarium* fulvo-tomentosum, circiter 1·5 cm. longum, 3 mm. latum, stipite fulvo-tomentoso 7 mm. longo ; stylus falcato-curvatus, circiter 1·5 cm. longus, basi excepta glaber ; ovula 6. *Legumen* oblanceolatum, maturum fere ad 25 cm. longum, prope apicem ad 5·5 cm. latum, extra dense ferrugineo-tomentosum, intus spongiosum ; semina nigra, circiter 2·5 cm. longa, ad 1·8 cm. lata.

British Guiana. Mazaruni Station, in mixed forest on loose brown sand, fl. Jan. 12th, 1940, fr. April 12th, 1940, *Fanshawe* in *Forest Dept.* 3077 (typus) ; *ibid.*, in Greenheart–mixed forest heavily thinned out by fire, fl. Jan. 14th, 1933, *Davis* in *Forest Dept.* 2338 ; *ibid.*, fr. March 16th, 1909, *C. W. Anderson* in *Forest Dept.* 187 ; *ibid.*, fr. August 17th, 1934, *Archer* 2441. Tinamu Line, Lower Cuyuni River, in Wallaba forest on white sand, fr. 1931, *Davis* in *Forest Dept.* 1056. Makauria River, Essequibo River, fr. March 1909, *C. W. Anderson* in *Forest Dept.* 187 A. Pokorero Creek, Kamuni River, Demerara River, in swampy sand on creek bank, April 20th, 1923 (leaves only), *Hohenkerk* in *Forest Dept.* 187 B. Upper Demerara River, fl. September, 1887, *Jenman* 4240.

Field notes show that the tree varies from 88 to 122 ft. in height, and from 16 to 24 inches in diameter. Additional notes by Mr. Fanshawe are as follows : " Unbuttressed ; leaves glossy above, dull brownish-green below ; flowers cauliflorous, pedicels and calyx tomentose, ferrugineous in bud, flushed scarlet in flower ; corolla waxen, scarlet, tipped orange, with 4 oblong petals, the standard broad, retuse, revolute ; filaments scarlet, waxen ; anthers

orange." Mr. Davis writes of the flowers as " orange-scarlet, with very dark reddish-brown calyx. The tree from below appears to have the branches covered with deep scarlet flowers."

Vernacular name (Arawak), *Haiariballi.*

Officers of the Forest Department of British Guiana have for some years considered that the Arawak name Haiariballi covers two quite distinct trees, *Alexa imperatricis* (Rob. Schomb.) Baill. and a close ally, with different distributions in the Colony. The first of these, identified correctly with Robert Schomburgk's *Alexandra imperatricis,* is very abundant and dominant in certain areas of mixed forest on the higher ground of the North-West District, in other words, in the north-western portion of the *Eschweilera Sagotiana* (Kakaralli)—*Licania venosa* (Kautaballi) association which is the more western of the two associations representing the climatic climax of the vegetation of the British Guiana peneplain (see T. A. W. Davis, " Endemic trees of the British Guiana peneplain ", in Journ. Ecology, vol. 29, pp. 1–12 (1941)). It also occurs in the Pomeroon District, while Robert Schomburgk first discovered it far to the south-west on banks of the Wanamu River, which is a southern tributary of the Upper Cuyuni with its source in the Pakaraima Range. In the last locality, where Schomburgk camped at the end of 1842 or very early in January of 1843, the tree was known to the Arecuna and Macusi Indians as " Koa-toi ". That it occurs elsewhere on the Pakaraima Range has been proved by its rediscovery by Pinkus (coll. no. 171), at 2,000 ft. on the upper Arubaru River, a tributary of the Kaku River, to the south-east of the Wanamu and on the north side of Mt. Roraima. This discovery is recorded in Bull. Torr. Club, lxvii, 287 (1940), with the additional collector's note that the bark of the tree is used as a fish-poison. The appearance in the Pakaraimas of a tree which is abundant in the North-West District is of interest because Davis, in his paper in the Journal of Ecology cited above (p. 11), is not of opinion that the Pakaraimas have contributed many species, still less species occurring in abundance, to the flora of the forests of the peneplain, for which he postulates a very different origin.

Robert Schomburgk's figure and description of *Alexandra*—a name dedicated in a special dissertation to Alexandra Feodorowna, Tsarina of all the Russias, and preoccupied by *Alexandra* Bge. in the *Chenopodiaceae*—as well as his specimen in the Kew Herbarium leave no doubt of the identification of *Alexa imperatricis* with this tree, recent collections of which are as follows: Yarikita River, N.-W. District, foliage only, April 13th, 1929, *Forest Dept.* 916; Aruka River, N.-W. District, fr. July 6th, 1908, *C. W. Anderson* in *Forest Dept.* 11; Hosororo, Pomeroon District, fl. and fr. July 12th, 1934, *Archer* 2259 (noted as a fish-poison); *ibid.*, fl. July 29th, 1934, *Archer* 2411; Mairaka, Pomeroon River, fl. March 2nd, 1932, *Davis* in *Forest Dept.* 2276. Some idea of its abundance and

distribution may be gathered from Davis' paper on " Some Observations on the forests of the North West District ", in Agric. Journ. Brit. Guiana, ii. 157–166 (1929). The first name combination under the substituted generic name *Alexa* Moq. was made by Baillon, Hist. Pl. ii. 362, in adnot. (1870), and not, as has been supposed, by Baker in Hook. Ic. Pl. t. 1794 (1888).

The second Haiariballi, which is described above, has not been found in the North-West or Pomeroon Districts, but is frequent in the drier climate of the Cuyuni–Mazaruni–Essequibo River region and occurs more rarely in that of the Demerara River (see Davis, Journ. Ecology, 1941, l. c. 8), where it was first collected by Richard Schomburgk whose record " Auf den Sandhills am Demerara ", in Reisen in Britisch Guiana, iii. 1033 (1848), must refer to this species. In Richard Schomburgk's Reisen, ii. 488–489 (1848), and transl. Roth, ii. 390–391 (1923), we read that Schomburgk found isolated examples of the tree in April 1844, while travelling alone up the Demerara River, at a point on the western bank not far above Georgetown where there is a low chain of hills called " the Sandhills ". This locality, described as above the mouths of the " Cammoni " and Madewini Rivers, cannot be far from the spot where Hohenkerk collected *A. leiopetala* on the Kamuni River in 1923. The tree was described as generally 100–110 ft. high, with brown pods mostly 18–20 in. long. Unfortunately, leaves and flowers of Richard Schomburgk's material are not represented at Kew. From the evidence of field-notes, this second Haiariballi has been found in the Wallaba (*Eperua*), Greenheart and Mixed forest consociations. Jenman's gathering on the Upper Demerara River in 1888 was unfortunately figured by Baker in Hooker's Icones as *Alexa imperatricis*, and Baker's description, except for the details of the height of the tree (90–120 ft.), the colour of the petals (" aurantiaca "), and the pod and seeds, all taken from Robert Schomburgk's account of *Alexandra imperatricis*, applies to *Alexa leiopetala*.

Herbarium study of the material available provides enough evidence for the definition of the two Haiariballis as distinct species. The leaflets of *A. leiopetala* are relatively shorter and narrower than those of *A. imperatricis* which may attain a length of 30 cm. and a breadth of 13 cm., and their acumen is longer, narrower and therefore usually far more noticeable. But the best distinguishing character in the foliage lies in the very minute pubescence on the lower surface of the leaflets of *A. leiopetala*, and found also on the petiolules, rhachis and branchlets. This is sometimes obvious, but is evanescent with age, and on some sheets (e.g., *Jenman* 4240) can be seen only under a lens of high power ; but it is always present, whereas the leaflets of *A. imperatricis* are completely glabrous, and the rhachis and branchlets practically so. The inflorescences of the two species are very similar in general appearance, that of *A. leiopetala* being on a smaller scale with the bracts often persistent and evident, whereas the bracts of *A. imperatricis* fall early and have not been seen. The calyx of *A. imperatricis* is larger than that of its ally, and reaches

a length of 2·5 cm. The petals of *A. imperatricis* are sometimes, but not always, longer than those of *A. leiopetala* and, instead of being completely glabrous, are always densely and conspicuously subsericeous-pubescent on the lower two thirds (except for the glabrous margins) of the outer surface. As to their colour, from the evidence of field-notes and descriptions, it seems that the standard of both species is deep red, but that whereas in *A. imperatricis* the 4 lower petals are mainly orange-yellow, merging to deep red towards the base, in *A. leiopetala* the same petals are orange-scarlet or scarlet tipped with orange. Two other distinguishing characters have been discovered in the flowers : the anthers of *A. imperatricis* are longer than those of *A. leiopetala*, being 6·5-7·5 mm. long ; and the stipe of the ovary is glabrous (as described by Schomburgk) in *A. imperatricis* except immediately below the ovary, whereas in *A. leiopetala* it is tomentose throughout its length. In spite of Schomburgk's delineation of a full ovary with 12 ovules, only 6 ovules, in the abaxial half, have been found in such ovaries of both species as have been dissected. Evidence from the fruits and seeds is not yet complete, since only two good pods and no seeds of *A. imperatricis* have been seen. One of these pods was sent to Kew from Berlin by Prof. Eichler in 1882 and was evidently collected by either Robert or Richard Schomburgk (if by the latter, it may be a pod of *A. leiopetala*) ; the other is from C. W. Anderson's collection from the Aruka River, N.-W. District, cited above. Both have dehisced and lost their seeds, and both are about 27 cm. long, with the same tomentum and about as broad as those of *A. leiopetala* ; the gap left by one of the seeds in Schomburgk's pod is about 3·5 cm. long. Fragments of pods collected by Archer are not helpful. Robert Schomburgk described the pods of *A. imperatricis* as 18–20 inches long and $2\frac{1}{2}$ inches broad, dimensions of length which were repeated by his brother when writing of *A. leiopetala* and which greatly exceed those of the available examples of both species. He described the seeds of *A. imperatricis* as chestnut-coloured and of the size of a chestnut, $1\frac{1}{2}$ inches long, $1\frac{1}{4}$ inches broad and $\frac{1}{2}$ inch thick. If these characters are constant the seeds of *A. imperatricis* are larger than those of *A. leiopetala* and possibly of a different colour, since those of two collections of the latter species are black when dried.

These Haiariballis are both, so far as is known, endemic in British Guiana, but *A. imperatricis* probably occurs in Eastern Venezuela in forests near the Orinoco Delta : they are remarkably distinct from the three other known species of *Alexa*, *A. Wachenheimii* R. Benoist of French Guiana and Surinam, and *A. grandiflora* Ducke and *A. bauhiniiflora* Ducke of Amazonian Brazil, all of which bear white or whitish-yellow petals.

XIII.—ADDITIONS TO THE FLORA OF BORNEO AND OTHER MALAY ISLANDS: XIX.*

THE PENTAPHRAGMATACEAE OF THE OXFORD UNIVERSITY EXPEDITION TO SARAWAK, 1932. H. K. AIRY-SHAW.

I. DESCRIPTION OF FAMILY.

Pentaphragmataceae *Airy-Shaw*, fam. nov. *Flores* hermaphroditi, actinomorphi. *Calycis tubus* ope septorum 4–5 longitudinalium cum staminibus continuorum ovario adnatus, foveis 4–5 profundis nectariferis petalis oppositis, campanulatus vel cylindricus; *lobi* 4–5, imbricati, membranacei, persistentes, inaequales, 2 majoribus cum 3 minoribus alternantibus. *Corolla* apice calycis tubi inserta, gamopetala (plerumque brevissime), plus minus campanulata, subcartilaginea, persistens, lobis 4–5 valvatis plerumque patentibus vel reflexis. *Stamina* 4–5, sepalis opposita, basi corollae adnata; filamenta persistentia; antherae oblongae, introrsae, basifixae, rimis dehiscentes. *Discus* 0. *Ovarium* inferum, 2-loculare, placentis axilibus bifidis multiovulatis. *Stylus* crassus, brevis, simplex; stigma magnum, ovoïdeum vel oblongum, sulcatum. *Ovula* minutissima, numerosissima, pendula, anatropa, integumento unico, sacculo embryonali e micropyle longe exserto (teste *Poulsen*). *Fructus* baccatus, indehiscens. *Semina* numerosa, minuta, testa castanea incrassata reticulata. *Embryo* minutus, radicula juxta hilum sita; albumen copiosum.

Herbae perennes, basi plus minus lignosae, saepe radicantes, succosae, pilis multicellularibus ramosis vestitae. *Folia* alterna, ampla, simplicia, saepe asymmetrica, denticulata vel integra, subcarnosa, exstipulata. *Inflorescentiae* laxe vel dense scorpioïdeo-cymosae, axillares. *Bracteae* et *bracteolae* saepe amplae. Flores pedicellati vel sessiles, albi vel virides vel aurantiaci. (Syn.: *Campanulaceae–Campanuloideae–Pentaphragmeae* [sic] Schönl. in Engl. et Prantl, Nat. Pflanzenf. ed. 1, IV. **5**, 40, 68 (1889); *Saxifragaceae* " sect. *Francfleuryae* " [sic] Chev. et Gagnep. in Rev. Bot. Appl. **7**, 663: 1927; " Pentaphragmacées " Gagnep. l. c. **8**, 622: 1928, in adnot., nom. provis.)

Genus unicum: **Pentaphragma** *Wall. ex G. Don*, Gen. Syst. **3**, 731 (1834). (Syn.: *Francfleurya* Chev. et Gagnep. in Rev. Bot. Appl. **7**, 663: 1927.)

Species typica: *P. begoniifolium* (Roxb. ex Jack) Wall. Cat. 1313 (1829) (*Phyteuma begoniifolium* Roxb. ex Jack in Mal. Misc. **1**, 5: 1820).

Species (including a few undescribed) about 25,† from Burma to New Guinea. Lower Burma 1, Siam and Indo-China 7, Kwangtung 1, Malay Peninsula 4, Lingga Archip. 2, Sumatra 3, Banka 1, Anamba

* Continued from K.B. 1940, 262.

† Diels in Engler, Syllabus Pfl.-Fam. ed. 11, 366 (1936), gives the number of species as 4 !

Is. 1, Borneo 8, Philippines 5, Moluccas 1, New Guinea 1. Almost all endemic and local, except *P. begoniifolium* (Roxb. ex Jack) Wall., Lower Burma, Peninsular Siam, Northern Federated Malay States ; *P. ellipticum* Poulsen (*P. Ridleyi* King et Gamble), Southern F.M.S. and Banka ; *P. grande* Ridl., Pahang and Sarawak ; *P. Scortechinii* King et Gamble, Peninsular Siam, F.M.S., Sumatra, Anamba Is.

Almost every author who has dealt with *Pentaphragma* has admitted its highly anomalous position in the *Campanulaceae*, and it is therefore surprising that it has not been removed earlier. It shows, however, so many possible links with other families, besides possessing so many unique features of its own, that it is at present scarcely possible to suggest a satisfactory place for it in any recognized system.

The habit and foliage suggest certain *Begoniaceae*, *Rubiaceae* (*Argostemma*, etc.) and *Gesneriaceae* (*Epithema*, etc.). The succulence of the stem and leaves recalls the *Cucurbitaceae*. The scorpioidally cymose inflorescence is very similar to that of many *Hydrophyllaceae* and *Boraginaceae*. According to Chevalier and Gagnepain, l. c. 662, and op. cit. **8**, 622 (1928), the "*pente phragmata*" connecting the calyx-tube with the ovary constitute a character of frequent occurrence in the *Melastomataceae*, but these authors cite no examples, and I know of none. The indumentum of branched multicellular hairs recalls that of the *Solanaceae*.

The large, unequal, persistent calyx-lobes, the subcartilagineous persistent corolla with valvate lobes, the five stamens with persistent filaments, and the short style and massive stigma, are also unusual characters, peculiar enough in themselves : taken together, in conjunction with those mentioned above, they form a combination sufficiently remarkable to characterize a very distinct family.

Chevalier and Gagnepain in 1927 described certain Indo-Chinese species under the generic name *Francfleurya*, referring the genus to the *Saxifragaceae*, but the following year Gagnepain discovered the mistake, having overlooked *Pentaphragma*. Although the latter author speaks of " l'aspect général qui rappelle celui des *Saxifraga* de la section *Bergenia* ; l'ensemble des caractères qui correspond bien à la famille des Saxifragacées," I have been unable to find any convincing evidence of Saxifragaceous affinity.

Hans Hallier, who could usually be trusted to spot an anomalous genus, leaves *Pentaphragma* in *Campanulaceae*, merely pointing out the similar scorpioidally cymose inflorescences in *Boraginaceae* and certain *Convolvulaceae** (*Jacquemontia*) and *Loasaceae* (*Kissenia*) (H. Hallier, " Ueber Juliania ", etc., in Beih. Bot. Centralbl. **23** (2), 127, 132 : 1908). In Hallier's system (l. c. 176–198), which in spite of some startling and obvious defects deserves very careful consideration, *Pentaphragmataceae* would fall either in "*Peponiferen*" (p. 187), "*Tubifloren*" (p. 195) or "*Campanulinen*" (p. 197).

* Cf. also *Mina*, *Cardiopteris* (Beccari in Nuov. Giorn. Bot. Ital. **9**, 106 : 1877), *Cuscuta*.

Dr. C. R. Metcalfe has been good enough to examine the anatomy of representative species of the genus. The main points in his report are the following :—

" 1. The stomata are surrounded by an inner ring of 3 or sometimes 4 subsidiary cells, whilst around these there is an outer but less distinct ring of subsidiary cells. This arrangement is not common amongst the Dicotyledons as a whole, but it occurs in, and is particularly characteristic of, the *Begoniaceae*.

" 2. The vessels are provided with scalariform thickening of the type which occurs throughout all the examined members of the *Begoniaceae*. This again is a very rare character amongst the Dicotyledons . . . Scalariform *thickening* is far less common amongst the Dicotyledons even than scalariform *perforations*.

" 3. There is nothing about the general structure of the petiole or of the stem which is inconsistent with the suggestion that the plant may belong to the *Begoniaceae*. On the other hand none of these characters support the inclusion of *Pentaphragma* in the *Solanaceae, Campanulaceae* or *Lobeliaceae*."

No suggestion that *Pentaphragma* actually belongs to the *Begoniaceae* is, of course, here made. Morphologically it has little in common with that family beyond the habit, succulence and asymmetrical leaves. This makes the extraordinary agreement in important anatomical details all the more remarkable. For the present it seems probable that the question of the true affinity of this family must be left open. For a fairly detailed (but inconclusive) discussion of the anatomy of *Pentaphragma*, with a few remarks on relationships, the reader is referred to the article by V. A. Poulsen in Vidensk. Meddel. Naturh. Foren. Kjöbenh., 1903.

II. Enumeration of Specimens.

Pentaphragma grande *Ridley* in Journ. Linn. Soc. **38,** 312 (1908) ; Fl. Mal. Penins. **2,** 203 (1923).

Dulit Ridge, growing on moss-covered ground in moss forest, very damp, *c.* 1290 m., 5 Sept., *Synge* 400 : " Herb, *c.* 3′. Stem thick. Leaves large, slightly fleshy, prominently veined, light green. Flowers white, tubular. Petals green at base."

This very distinct species has hitherto been known only from Gunong Tahan, Pahang, the type locality. The Bornean specimens agree well with the type collection of Robinson and Wray. The few-flowered inflorescences and the unusually thick and fleshy consistency of the sessile flowers immediately distinguish it from the other large-flowered species such as *P. philippinense* Merr., *P. albiflorum* H. H. W. Pears., *P. grandiflorum* Kurz, *P. macrophyllum* Oliv., etc.

Pentaphragma albiflorum *H. H. W. Pearson* in Hook. Ic. Pl. ser. 4, **8**, t. 2706 (1901) ; Merrill in Sar. Mus. Journ. **3**, 556 (1928).

Dulit Ridge, "transition" forest, *c.* 1200 m., 9 Sept., *Native Collector* 1650 : "Leaves thick and sappy. Calyx greenish white, corolla pale yellow."

The flowers are rather larger than in the type, and the anthers have no trace of the two apical cusps shown in the plate in Hooker's Icones, but the specimens otherwise agree well.

XIV. MISCELLANEOUS NOTES.

Sir Arthur William Hill.—Shortly before this number of the Bulletin went to press, the Royal Botanic Gardens sustained a grievous loss in the death of the Director, Sir Arthur William Hill, K.C.M.G., Sc.D., D.Sc.(Adelaide), F.R.S., who was killed in a riding accident on November 3rd, 1941.

Sir Arthur had been officially connected with Kew for thirty-four years, for the first fifteen as Assistant Director. He succeeded Sir David Prain as Director in 1922, and his long service at Kew will always be a landmark in the history of the establishment. He had travelled widely, and was personally known to botanists in all parts of the world. To these, and especially to botanists in various parts of our overseas Empire, his death must bring a great sense of personal loss.

It is hoped to publish a full account of Sir Arthur's life in the next number of the Kew Bulletin.

Sir Geoffrey Evans, C.I.E., M.A., has been appointed Acting Director by the Ministry of Agriculture and Fisheries.

Leonard Alfred Boodle.—We mourn the death on August 22nd, 1941, of L. A. Boodle, who was a member of the Kew Staff for nearly 26 years, being first an Assistant, and then for 21 years Assistant Keeper of the Jodrell Laboratory. He was appointed Assistant in the Laboratory on 1st October, 1904, but for six years before that time he had acted as Private Assistant to Dr. D. H. Scott, F.R.S., who was Honorary Keeper of the Jodrell Laboratory from 1892 to 1906 (*see* Kew Bulletin, 1892, p. 248, and 1906, p. 383). On the retirement of Dr. Scott, Mr. Boodle took charge of the Laboratory, and he was appointed Assistant Keeper on 5th February, 1909, retiring on 3rd May, 1930, on reaching the age limit (Kew Bulletin, 1930, p. 328).

He was educated at King's College School and at the Royal College of Science, graduating A.R.C.S., and was for seven years Demonstrator in Botany at the College under Dr. Scott. Before coming to Kew he worked on Marine Algae and spent some time in South Africa. His Algae work was done with the late Dr. George Murray at the Natural History Museum, and the genus *Boodlea* (*Siphoneae*) was named after him.

His association with Dr. Scott turned his interests towards plant anatomy, and he published several papers on the subject jointly with him. Later he embarked with Professor F. E. Fritsch on the translation of Solereder's great work on the Anatomy of Dicotyledons, but with his meticulous care over small details, and his difficulty in selecting the exact equivalents in English for the German, he did not complete his share of the work, and it was finished by Professor Fritsch alone.

Boodle's knowledge of Botany and botanical literature was remarkable, and he was a critic of rare value both of his own and of his fellow botanists' work. So keenly developed was his critical outlook that he rarely expressed his results in print, and much of the excellent work he did has never been published. His diffidence of his own powers also, unfortunately, prevented him from reading papers, or giving lectures before scientific societies, except on one or two occasions, so that he was well-known only to botanists working in his own line of study, by whom his wide knowledge and critical ability was often sought and highly appreciated.

His series of papers on the vascular structure of the Pteridophyta will always remain a monument to his careful work and painstaking attention to detail. Professor E. J. Salisbury writes: "He was a man for whose profound anatomical knowledge and surefootedness we all had the greatest respect. His extreme modesty and retiring nature led to many not appreciating to the full his great gifts."

Highly strung, gentle, unselfish and outstandingly generous, Boodle was well-known to only a few intimate friends. They, however, found him a valued friend, with a keen sense of humour, which found expression in various ways; thus, he wrote clever parodies of certain well-known papers in the Annals of Botany. These were circulated among his friends, but he was, unfortunately, always careful to destroy them. He was keenly interested in the fine arts, especially music and painting, and was a good critic. He was a devout member of the Church of England. He married in 1912 a Swiss lady, Mrs. Emery, and we offer our sincere sympathy to her in her bereavement.

A. W. H.

List of papers published by Mr. L. A. Boodle :—

(With A. Calvert) On Laticiferous Tissue in the pith of *Manihot Glaziovii* and on the presence of Nuclei in this Tissue. Ann. Bot., 1887, **1**, 1–8, 1 pl.

On some points in the Anatomy of the Ophioglossaceae. Ann. Bot., 1899, **13**, 377–394, 1 pl.

Stem Structure in the Schizaeaceae, Gleicheniaceae, and Hymenophyllaceae. Ann. Bot., 1899, **13**, 624–625.

On the Structure of the Stem in two species of *Lycopodium*. Ann. Bot., 1900, **14**, 315–317.

Comparative Anatomy of the Hymenophyllaceae, Schizaeaceae and Gleicheniaceae. I. On the Anatomy of the Hymenophyllaceae. Ann. Bot., 1900, **14,** 455–496, 3 pls.

II. On the Anatomy of the Schizaeaceae. Ann. Bot., 1901, **15,** 359–419, 3 pls.

III. On the Anatomy of the Gleicheniaceae. Ann. Bot., 1901, **15,** 703–747, 2 pls.

On an anomalous leaf of *Anemia hirsuta* Sw. Ann. Bot., 1901, **15,** 765–766.

On Lignification of the Phloem of *Helianthus annuus*. Ann. Bot., 1902, **16,** 1–4.

IV. Further Observations on *Schizaea*. Ann. Bot., 1903, **17,** 511–537.

On Descriptions of Vascular Structures. New Phyt., **2,** 1903, 107–112.

Succulent Leaves in the Wallflower (*Cheiranthus Cheiri* L.). New Phyt., 1904, **3,** 39–46.

Secondary Tracheids in *Psilotum*. New Phyt., 1904, **3,** 48–49.

The Structure of the Leaves of the Bracken (*Pteris aquilina* Linn.) in relation to Environment. Journ. Linn. Soc. Bot., 1904, **35,** 659–669.

On the Occurrence of Secondary Xylem in *Psilotum*. Ann. Bot., 1904, **18,** 504–517, 1 pl.

The Monoecism of *Funaria hygrometrica* Sibth. Ann. Bot., 1906, **20,** 293–299.

Lignification of Phloem in *Helianthus*. Ann. Bot., 1906, **20,** 319–321.

N'Hangellite and Coorongite. Kew Bull., 1907, 145–151.

Report on defective oak spoke. Kew Bull., 1908, 135.

Raffia fibre from Madagascar. Kew Bull., 1908, 207–208.

Report on yield of Rubber from two tubers of *Raphionacme utilis*. Kew Bull., 1908, 306, 307.

On the production of Dwarf Male Prothalli in Sporangia of *Todea*. Ann. Bot., 1908, **22,** 231–243.

On the Occurrence of Different Types of Hair in the Wallflower. Ann. Bot., 1908, **22,** 714–716.

(With W. E. Hiley) On the Vascular Structure of some species of *Gleichenia*. Ann. Bot., 1909, **23,** 419–432, 1 pl.

Mummy-coffin wood. Kew Bull., 1909, 74–76.

(With O. Stapf) *Peglera* and *Nectaropetalum*. Kew Bull., 1909, 188–191.

Padi. Kew Bull., 1909, 277–279.

(With T. A. Sprague) Kokoti (*Anopyxis ealaënsis* Sprague). Kew Bull., 1909, 309–312.

Remedies for snake-bite. Kew Bull., 1909, 343–345.

Galls on an Indian Grass. Kew Bull., 1910, 69–73.

(With W. Dallimore) Report on investigations made regarding "Beech Coccus" (*Cryptococcus fagi* Bärensprung). Kew Bull., 1911, 332–343.

(With W. B. Turrill) A Hybrid Heath. Kew Bull., 1911, 378–379.

The Root and Haustorium of *Buttonia natalensis*. Kew Bull., 1913, 240–242.

On the Trifoliate and other Leaves of the Gorse (*Ulex europaeus* L.). Ann. Bot., 1914, **28**, 527–530.

Cold storage of fruit and vegetables. Kew Bull., 1914, 11–16.

(With T. A. Sprague) West Indian Boxwood. Kew Bull., 1914, 214–219.

The Ringing of Trees. Kew Bull., 1914, 222–225.

Concrescent and Solitary foliage leaves in *Pinus*. New Phyt., 1915, **14**, 19–22.

Abnormal Phyllotaxy in the Ash. Ann. Bot., 1915, **29**, 307–308.

Thyrsopteris elegans. Kew Bull., 1915, 295, 296, 1 pl.

A Method of Macerating Fibres. Kew Bull., 1916, 108–110.

The Exhalation of Scent by the Flowers of *Michelia fuscata*. Kew Bull., 1916, 185–188.

The Preservation of Leafy Twigs of the Beech. Kew Bull., 1917, 229–231.

The Nature of Charred Wood. Kew Bull., 1917, 306–308.

The Introduction of Spruce Fir into Britain. Kew Bull., 1917, 336–339.

The Mode of Origin and the Vascular Supply of the Adventitious Leaves of *Cyclamen*. Ann. Bot., 1920, **34**, 431–437.

(With W. Dallimore) Bamboos and Boring Beetles. Kew Bull., 1920, 282–285.

Ravison as a Commercial Term. Kew Bull., 1921, 115–117.

Mistletoe on Lime Trees. Kew Bull., 1921, 212–215.

The Bacterial Nodules of the Rubiaceae. Kew Bull., 1923, 346–348.

Mistletoe on Oaks. Kew Bull., 1924, 331–333.

(With Sir A. W. Hill) *Typhonodorum Lindleyanum*: the Development of the Embryo and Germination of the Seed. Ann. Bot., 1929, **43**, 437–450, 1 pl.

Charles Henry Wright.—We record with deep regret the death of Mr. C. H. Wright which occurred at his home at Seaton, Devon, on June 21, 1941. Mr. Wright was a member of the Herbarium Staff for 45 years and was therefore well-known to a wide circle of botanists. He was born at Oxford on June 5, 1864, and was educated at New College School, and received his early training in botany at the Herbarium and Laboratory of the Oxford Botanic Garden. He was appointed an Assistant in the Herbarium at Kew in 1884. His care and accuracy were soon noted by the authorities, and the task of checking the manuscripts and reading the proofs of the great Kew floras—" Flora Capensis " and " Flora of Tropical Africa "—was after a time allotted to him by Sir William Thiselton-Dyer, and in 1899 he became sub-editor. On Dr. W. B. Hemsley's retirement from the Keepership in 1908 he was appointed Assistant Keeper in succession to Dr. Stapf.

Wright's special groups were the *Bryophyta* and the *Pteridophyta*, and amongst Flowering Plants he had charge of the Petaloid Monocotyledons and Palms. His most important work from the Herbarium point of view was probably that which he did on the Ferns and on the families *Liliaceae* and *Amaryllidaceae*. Notwithstanding his many other duties he found time to elaborate many families for the Floras, particularly *Boraginaceae, Solanaceae, Proteaceae* (with J. G. Baker), and *Palmae* in the " Flora of Tropical Africa ", and the *Solanaceae, Boraginaceae, Chenopodiaceae, Polygonaceae* and *Thymelaeaceae* in the " Flora Capensis ".

He also wrote several papers and monographic studies which were published in the Linnean Society's Journal or elsewhere. The details with regard to the receipt of all specimens were for many years in his hands, so that he had an unrivalled knowledge of the history of the Kew Collections. Another charge in which he took special interest was the very extensive collection of drawings and photographs of plants which is maintained in the Herbarium.

After his retirement under the age-limit in August, 1929, Wright settled with his family at Seaton, and characteristically threw himself at once into local social and church affairs and into the study of the local flora. He was enthusiastic in assisting in the production of the new and excellent " Flora of Devon " which was published in 1939 under the auspices of the Devonshire Association.

Wright became an Associate of the Linnean Society by election as a young man of 32, an honour which he greatly appreciated, and he persistently refused to allow his name to be put forward for the Fellowship. He followed J. G. Baker as lecturer to the student gardeners in Systematic Botany, a duty he continued to carry out until he retired. Wright, who served under four Directors and five Keepers of the Herbarium, will always be remembered for his meticulous care in those lines of work in which he was especially interested, and for his genial manner and the friendly hand which he extended to the new and younger members of the Staff.

A. D. C.

Edward Barnes.—With great regret we record the death in Madras on the 31st May, 1941, of Professor Edward Barnes, from pneumonia supervening on malaria, at the early age of 49. Though a Professor of Chemistry at the Madras Christian College, Barnes developed a great taste for botany, and of late years he took every opportunity for studying and collecting the plants of South India and devoted most of his holiday time to botanical excursions in the South Indian hills. He paid particular attention to the genera *Arisaema, Impatiens* and *Sonerilla*. His specimens were always good, frequently including material in formalin, and sometimes accompanied by useful notes and sketches. He had the knack of inducing the specimens to retain their natural colours to a remarkable degree. Many of the plants collected by him were new; and all

these were described, some by himself, and published in the Bulletin or in the Icones Plantarum.

While on furlough he worked for some time in the Herbarium on the specimens he had brought home.

C. E. C. F.

The Garden Clinic.*—Of popular works for the amateur gardener there is no end. The present book strikes a new note in a series of line drawings, arranged in double-page plates, which demonstrate pictorially the cultivation of various popular flowering plants and the treatment of some of their pests. As the book is written for American gardeners, some of the popular names of plants are unfamiliar, and some of the pests, notably insects, do not occur here. The general principles, however, appear to be sound, and the directions given are clear and not overburdened with technical detail. The illustrations are somewhat diagrammatic and at times amusing.

The various chapters deal in turn with annuals and perennials, Irises, Lilies, Roses, bulbous plants, evergreens, flowering trees and shrubs, hedges, climbers and waterlilies. There are brief notes as to culture, and mention of the chief diseases and pests which may attack these plants. Both plants and pests are for the most part referred to by their common names. A chapter on the treatment of cut flowers completes the work and an index is provided. The book should prove useful to beginners, especially when they can once more turn their attention from vegetables to flowers.

E. M. W.

The Lily Year-Book.†—In spite of the adverse conditions during 1940 the Royal Horticultural Society has published another Number of its Lily Year-Book. Amongst scientific articles there are three concerning the breeding and hybridising of lilies, and a short but valuable account by D. E. Green and M. A. H. Tincker on Mosaic in the two important commercial Lilies *L. auratum* and *L. speciosum*. Short articles of practical importance, accounts of several gardens where lilies are grown, and a miscellaneous series of notes make up the balance of an interesting and readable Number.

British Trees.—We have received a copy of a new edition of Step's "Wayside and Woodland Trees"‡ which has been revised and brought up-to-date. In addition to the numerous colour and half-tone plates which illustrate the volume, a useful section providing keys and illustrations of the leaf and winter-bud characters of the different species has been added.

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* By Laurence Blair. Macmillan & Co., Ltd., 1940, pp. xii + 146, numerous black and white illustrations. Price 8s. 6d.

† "Lily Year-Book, No. 9, 1940." Royal Horticultural Society, London, 1940, pp. 96, 26 figs. Price 5s. paper, 6s. cloth.

‡ "Wayside and Woodland Trees." A guide to the British Sylva, by E. Step. Revised by A. Keith Jackson and A. Bruce Jackson, 1940. 186 pp., 24 colour plates, 151 half-tone plates, 58 text figs. Published by Frederick Warne & Co., Ltd., London and New York. Price, 10s. 6d.

Botanical Magazine.—Part iii of Vol. clxiii was published on June 3rd, in place of Part ii, the text and coloured plates of which were unfortunately destroyed by enemy action. Part ii should be published shortly.

Part iii contains the following illustrations:—*Kalanchoe Schimperiana* A. Richard (t. 9623) from Abyssinia and S.W. Arabia; *Rhododendron parmulatum* Cowan (t. 9624) from South-eastern Tibet; *Fritillaria Drenovskii* Degen and Stojanoff (t. 9625), a native of the S.W. Rodope Massif and E. Macedonia; *Adenophora coelestis* Diels (t. 9626) from N.W. Yunnan; *Peddiea africana* Harvey (t. 9627) from Eastern South Africa to the E. Transvaal; *Iris innominata* L. F. Henderson (t. 9628), a native of the Rogue River valley, Oregon; *Gaultheria Miqueliana* Takeda (t. 9629), a Japanese species; *Lathyrus splendens* Kellogg (t. 9630), a native of San Diego County and Lower California; *Bulbophyllum leopardinum* (Wallich) Lindley (t. 9631) from Nepal, Sikkim and Assam; *Richea scoparia* Hook. f. (t. 9632) from Tasmania, allied to *R. Gunnii*, re-examination of which reveals two distinct species, one from Tasmania, the other from the mainland, which have been named *R. angustifolia* B. L. Burtt and *R. continentis* B. L. Burtt respectively. The final plate is of *Beloperone guttata* Brandegee (t. 9633) from Mexico. Under this a new combination, *B. fulvicoma* (Schlecht.) A. W. Hill, has been made.

Agriculture in Uganda.*—A detailed account is given of the crops grown in Uganda and particular attention is paid to the two most important export crops, viz., coffee and cotton. The diseases and pests attacking these crops are also described fully. Of particular interest, and especially because investigators in other countries find the information difficult to procure, are the chapters dealing with the topography, soils and native methods of agriculture. Full accounts are also given of the history and organization of special sections of the agricultural department, such as the Botanic Gardens at Entebbe, which owed much in the early days to importations from Kew. It will be interesting, after the lapse of a decade or so, to compare the condition of native agriculture then with the situation that is so carefully and accurately portrayed in the chapters written by the various District Agricultural Officers. For instance, will the efforts of the Department succeed in checking soil erosion, and will a system of rational farming on a rotation basis be established in place of the existing methods which are largely based on shifting cultivation?

The book is a valuable record of agriculture as it exists today in Uganda and of the measures that are being taken to effect its improvement.

G. E.

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* *Agriculture in Uganda*, by the Staff of the Department of Agriculture. Edited by J. D. Tothill, D.Sc. 551 pp., 30 plates. Oxford University Press, Oxford, Price 20*s*. net.

Botanical Laboratory Technique.* — In well-established botanical laboratories it is usual to find that either the chief attendant or some other member of the staff keeps a book or index of what may be termed botanical prescriptions. These much-valued compendiums, built up from years of practical experience, contain directions for preparing stains, chemical reagents, culture solutions and so forth. They often include extracts from tables of physical constants together with various particulars of the type which is usually to be found at the beginning of the more technical type of pocket diary. The information in these notebooks and indexes is as essential to the botanist as is the accumulated culinary wisdom of Mrs. Beeton and other authorities to the housewife.

The compilers of " Plant Science Formulae " have now collected a selection of all of these different kinds of information in a single small volume. A book of this kind should be welcomed with open arms by all laboratory workers, and especially by those in new laboratories without much traditional knowledge of practical technique. It is true that some aspects of the subject have already been treated in rather more detail in well-known books on chemistry and botanical microtechnique, but the reviewer is not aware of any previous work which covers so wide a range of subjects in so small a space.

It is impossible to give a complete account of the contents of the book in a short review, but some indication of its scope may be indicated by saying that it includes directions for preparing most of the stains, reagents, culture solutions, solid nutrient media, solutions for volumetric analysis, etc., which are in everyday use in a botanical laboratory. Physical constants, workshop recipes and directions for preparing museum specimens are also included, together with the names and addresses of firms who supply botanical equipment.

That the book is incomplete is fully recognised by the authors, who have left blank pages at intervals for the insertion of additional or improved recipes. In this connection it may be mentioned that Boodle's admirable method for macerating commercial fibres (Kew Bull., 1916, p. 108) would be a useful addition. Also the little-known but valuable practice of impregnating bundles of fibres with glycerine gum to enable freehand sections to be cut for quick microscopical examination might well be included. Kisser's procedure (Cytologia, 1931, **2**, 283–289) for making preparations of the leaf epidermis with sulphuric acid, and the methods which have been used on the Continent and in Japan for preparing spodograms (Botanical Review, 1940, **6**, 204) are not as familiar as is desirable, and might well be brought to light in a book of this kind. Then, again, the use of hydrofluoric acid for softening hard materials such

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* " Plant Science Formulæ," by R. C. McLean, M.A., D.Sc., F.L.S., and W. R. Ivimey Cook, B.Sc., Ph.D., F.L.S. London, Macmillan & Co., Ltd., 1941, pp. vi + 203. Price 7*s.* 6*d.* net.

as wood before cutting sections of them is not mentioned. Sections of particularly difficult material such as palm trunks can be prepared only by special methods such as the one devised by Kaul (Current Science, 1935, **4**, 99–102) which has given particularly successful results. Instructions for reviving dried herbarium and museum specimens so that they can be examined microscopically would also be useful. If these and other omissions, which will doubtless become apparent, could be made good in future editions, the value of the book would be still further increased. It would also be easier to use the book if the items in each section could be arranged in alphabetical order. The occasional cross references, given in cases where a reagent is mentioned on more than one page, are incorrect. This fact is realised by the publishers who propose to insert an erratum slip to this effect. The main index is, however, in order apart from a few omissions.

There is also room for improvement in the title of the book, which does not at present clearly indicate the nature of its contents. The word "formula" has been used in several different senses both in scientific circles and elsewhere, so that its present significance is not at once apparent. And why is it necessary to speak of "plant science" when the well-established word "botany" is available?

These suggestions are intended to be constructive. They do not belittle the book, which it is hoped will be very widely used in botanical laboratories.

C. R. M.

Vegetable Gardening in Malaya.*—This book deals with the production of vegetables in the wet tropics, and although it is naturally concerned with Malaya, yet its contents are readily applicable to other regions with similar climates. The senior author has already been associated with two previous publications on the same subject and has brought over twenty years experience to bear in the present issue. Unlike most of the other books on gardening in the tropics, this volume confines itself solely to vegetable production, and there is therefore ample space to deal with the problems involved from all angles. We thus find chapters dealing with the soils, which incidentally are admitted to be, for the most part, poor, the methods of cultivation, irrigation and the preparation of composts and the use of fertilisers. An all too short chapter is devoted to vegetable growing in the hills, which in the tropics presents unusual aspects owing to the excessive rainfall, high humidity and relatively low temperature. A method of raising vegetables of European origin under specially designed frames is of particular interest. The economics of vegetable growing is also discussed. This is a subject of particular importance at the present time, as

* By J. N. Milsum and D. H. Grist, pp. 206. Published by the Department of Agriculture, Straits Settlements and Federated Malay States, Kuala Lumpur. Price $2.

Malaya has always been a large importing country and the lack of shipping and the need to be self-supporting during wartime is therefore an urgent necessity. Another novel feature deals with the nutritional value of the various groups of vegetables. A description of the more usual types grown is given, with illustrations. It is obvious how much the inhabitants of Malaya are still dependent on the skill and industry of the Chinese immigrants who have flocked into the country in the past. The book is commended to the attention of all interested in vegetable production in the tropics.

G. E.

A Revision of Melanconis, Etc.*—Since the publication of his "Monograph of the genus Diaporthe" (see Kew Bull. 1934, p. 224) Dr. Wehmeyer has continued his careful studies of stromatic fungi allied to *Diaporthe*. He considers that the loose arrangement of asci and the broad, band-like evanescent paraphyses in *Melanconis* and *Pseudovalsa* indicate relationship with the *Diaporthe* group, and has now published the result of his work on species described under the generic names *Melanconis*, *Pseudovalsa* and *Calospora*. The author recognises the four genera mentioned in the title of the book. The genus *Calospora* is rejected, *Calospora* Sacc. (1883) being a synonym of *Prosthecium* Fres. (1852) emend. Wehmeyer, and the earlier *Calospora* Nit. in Fuck. Symb. Myc. (1869) a synonym of *Melanconis* Tul. (1863). In an appendix, however, Dr. Wehmeyer discusses all species which have been described under *Calospora*, and also species of *Massaria* and *Aglaospora* which have been described as *Pseudovalsa*.

After an introduction giving brief historical notes as to genera, a discussion of relationships, and some account of the distribution of species, there follows a key to all genera included in the *Diaportheae*. Species of the four genera mentioned in the title are then described in detail, and illustrated by careful drawings of perithecia, asci and spores.

As in the previous work, the typography is excellent, and both author and publisher are to be congratulated on the production of these valuable monographs.

E. M. W.

Index to Horticultural Abstracts, Volumes I–X., 1931–40.† The appearance of an index to the first ten volumes of Horticultural Abstracts, compiled by D. Akenhead, Deputy Director of the Imperial Bureau of Horticulture and Plantation Crops, East Malling, is noted with interest. The compilation which consists of both subject and author indexes will be welcomed by all subscribers to this periodical.

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* A Revision of Melanconis, Pseudovalsa, Prosthecium and Titania, by L. E. Wehmeyer, University of Michigan, Scientific Studies, Vol. XIV. University of Michigan Press, Ann Arbor, Michigan, U.S.A., 1941, pp. viii and 161, 11 uncoloured plates. Price $2·50.

† Published by the Imperial Bureau of Horticulture and Plantation Crops, East Malling, Kent, 1941. Copies obtainable on application to Central Sales Branch, Imperial Agricultural Bureaux, Agricultural Research Building, Penglais, Aberystwyth, Wales. Price 25s.

KEW BULLETIN.—The Editor will be glad to hear from persons or institutions having copies of the Kew Bulletin which they no longer require. After the war there will be a great need to help scientific institutions in many countries to restore their damaged or depleted libraries. The Editor is, therefore, anxious to obtain all available copies in order that the most effective use may be made of them at the conclusion of hostilities.

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